BIO NANONET

NEWSLETTER

04/2018

December 2018

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Editorial - *Contemporary issues from the network*

Dear Ladies and Gentlemen,

looking back on the work done this calendar year, we can summarize: it was a very successful year! Some highlights deserve to be emphasised.:

- the increasing number of network members → already 50+ organizations decided to be part of and benefit from this unique network. THANK YOU!
- the start of new projects: H2020-project **NanoCommons** (including BNN-members ACBN, UCD, NovaMechanics; and BNN itself); national FFG-nanoEHS-project **NanoAdd** (including BRIMATECH; and BNN as subpartner).
    - Furthermore, the successful project proposals H2020-NMBP-project **Gov4Nano** and H2020-FETOPEN-project **PRIME** can be announced; details will come in the next newsletter.
- the 2nd EU-Asia dialogue on Nanosafety (lead-organizer BNN) which was a big success, bringing together 80+ global experts to discuss and shape the future of nanosafety in 4 categories.

Of course, BNN is also heavily involved to **prepare itself and its members for forthcoming challenges**:

- to contribute to the new structuring of the framework programme **Horizon Europe** via the technology platforms strategic agendas,
- to **initiate and establish** new funding programs on regional and national level,
- to **support our members** in the preparation of proposals answering to forthcoming calls (final round of H2020, topics to be opened in autumn 2019) in the fields of NMBP, SPIRE, FOF, BHC, etc.

An important event on the road to this final proposal will be organized by BNN on February 27th, 2019, in Vienna, the "BNN-call-matchmaking"-Event at which our participants will have the chance to directly focus on specific topics for their preparation of proposals. This event will take place back-to-back with the 1st Austrian Microfluidics Initiative Symposium, which is kindly supported by the Technical University of Vienna. We are looking forward to seeing you there.

Have a Merry Christmas and all the best for a healthy, successful and happy New Year.

Sincerely,
BioNanoNet-Team

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BioNanoNet *News*

New BioNanoNet members

BioNanoNet is pleased to welcome its new extraordinary members:

Humboldt Innovation GmbH (Germany)

Humboldt-Innovation GmbH (HI) promotes and manages research and development agreements as well as contracts for scientific services between HU scientists and private companies or the public sector. On behalf of the university, HI will manage all project stages from initiation and launch to administration and completion.

The Innovation Management team supports HU scientists to recognize the commercialization potential of their research early on and to arrange for the necessary steps in this direction.

www.humboldt-innovation.de

ICCRAM - Universidad de Burgos (Spain)

ICCRAM (International Research Center in Critical Raw Materials for Advanced Industrial Technologies) was established in 2014 as a competence Center of the University of Burgos devoted to Critical Raw Materials (Spain).

This Center carries out different researching activities in four principal lines, all of them aimed to the development of new advanced materials (Synthesis of nanomaterials, Computational simulation, Nanosafety and Sustainability). From these lines, ICCRAM approaches different topics of interest at European level (Substitution of Critical Raw Materials, Design of new materials, Biophysics, Biotechnology, Industrial technology, Efficiency resources management, Circular economy and Eco-innovation).

www.ubu.es/iccram

Luxembourg Institute of Science and Technology (LIST) (Luxembourg)

Within the departments of the Luxembourg Institute of Science and Technology (LIST), our researchers and innovation experts develop skills and activities around three main domains: environment, IT and materials. Scientific excellence and interdisciplinarity are key to our projects.

The “Environmental Research & Innovation” (ERIN) department develops strategies, technologies and tools to better monitor, assess, use and safeguard natural and renewable resources. Its research topics are water security and safety, plant science and biotechnologies, life cycle sustainability and risk assessment, and e-Science.

The “IT for Innovative Services” (ITIS) department develops IT services within an open innovation process integrating all stakeholders concerned. Its research focuses on “big data” operational issues for decision-making, use of information systems in measuring and controlling the quality of services in networked enterprises, and tools for supporting innovation processes in IT services.

The “Materials Research and Technology” (MRT) department focuses its activities on advanced materials and nanotechnologies. Its research and technology activities target two main areas: nanomaterials and nanotechnology, and composite materials.

www.list.lu

Novamechanics (Cyprus)

Novamechanics Ltd (Cyprus) is an R&D performing SME dedicated in the development of novel algorithms and platforms to solve chemoinformatics, bioinformatics, nanoinformatics, modelling, simulation and medicinal & materials chemistry problems.

The company applies state of the art mathematical techniques, for the interpretation and implementation of validated predictive models to big data analysis, personalized medicine, clinical trials, computer aided drug discovery and material science. The aim is to increase profitability, decrease risk, and reduce experimental cost by conceiving new modelling ideas and devising the simulations needed to test them. NovaMechanics’ custom made in silico models and simulation tools are dedicated to the interpretation of research results and to the design of effective experiments in order to validate them.

www.novamechanics.com

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Publications

Critical considerations on the clinical translation of upconversion nanoparticles (UCNPs)

We are pleased to inform you that the publication from COST Action CM1403 entitled "Critical considerations on the clinical translation of upconversion nanoparticles (UCNPs) - Recommendations from the European Upconversion Network (COST Action CM1403)", by Helena Oliveira; Artur Bednarkiewicz; Andreas Falk; Eleonore Fröhlich; Darja Lisjak, PhD; Adriele Prina-Mello, PhD; Susanne Resch; Christa Schimmel; Ivana Vinković Vrček; Edyta Wysokińska; Hans H. Gorris, PhD, has now been published online in the Journal Advanced Healthcare Materials.

The article is available from https://doi.org/10.1002/adhm.201801233

EUROPEAN UPCONVERSION NETWORK COST Action CM1403 (2014-2018)

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BioNanoNet *member presentations*

Luxembourg Institute of Science and Technology

The Luxembourg Institute of Science and Technology (LIST) is a Research and Technology Organisation (RTO) active in the fields of materials, environment and IT. It is under the trusteeship of the Ministry of Higher Education and Research. LIST is the result of a merger of the CRP – Henri Tudor and the CRP – Gabriel Lippmann starting as of 1.1.2015.

LIST's mission is to conduct interdisciplinary, open-innovation and impact-driven research in a limited number of domains of high importance to business, industry and society. LIST is active throughout the whole innovation chain by performing: fundamental and applied scientific research; knowledge and capability development; experimental development, incubation and transfer of knowledge, products and services co-development; scientific policy support for the Luxembourg government, businesses and society and by doctoral and post-doctoral training.

Exposure of cells to a solution using the VitroCell Cloud chamber. © LIST

We contribute to Luxembourg's reputation through our participation in several targeted research areas among the best RTOs in Europe, and by doing so, accelerate the country's socio-economic development. Put in a nutshell, LIST contributes strongly to the building of tomorrow's Luxembourg. We foster synergies with the different key players in innovation in Luxembourg and working closely with the world of business and industry.

Together with our various institutional and private partners, we must actively contribute to the reindustrialisation of Luxembourg. With this in mind, we are not only active in building up long-lasting partnerships with the key economic players in Luxembourg, in order to consolidate their local presence. We are also developing a strategy of cooperation across Europe and worldwide in order to enhance Luxembourg's visibility, industrial appeal and welcome.

The Environmental Research and Innovation (ERIN) Department, led by Prof. Dr. Lucien Hoffmann, is constituted by more than 170 life science, environmental science and information technology researchers and engineers. The ERIN department provides the interdisciplinary knowledge and expertise to confront the major environmental challenges facing society such as climate change mitigation, ecosystem resilience, sustainable energy systems, efficient use of renewable resources, and environmental pollution prevention and control. The ERIN department implements its smart green vision geared towards pursuing scientific excellence in the understanding of complex environmental and biological systems and their interaction with the techno-sphere, so as to catalyse innovation aimed at sustainable natural resource management while integrating ICT breakthroughs. The department is positioned as a major contributor in implementing LIST's Smart Cities, Smart Space and Smart Manufacturing programmes, and in rolling out the Luxembourg government's circular economy strategy.

The activities in nano-toxicology and risk assessment are undertaken by the Environmental Health (EH) group, which belongs to the Life Cycle Sustainability and Risk Assessment research unit within the ERIN department. The team, which is led by Prof. Arno C. Gutleb, has extensive expertise in the testing and assessment of nano-materiels and fibres in respect to human and environmental health. In addition, the EH has large experience in the development of alternative testing strategies for nano-materials and in the development of *in vitro* 3D models, particularly for the lung (alveolar region) and the small intestine.

Contact:
Luxembourg Institute of Science and Technology
Dr. Arno Gutleb
arno.gutleb@list.lu
https://www.list.lu

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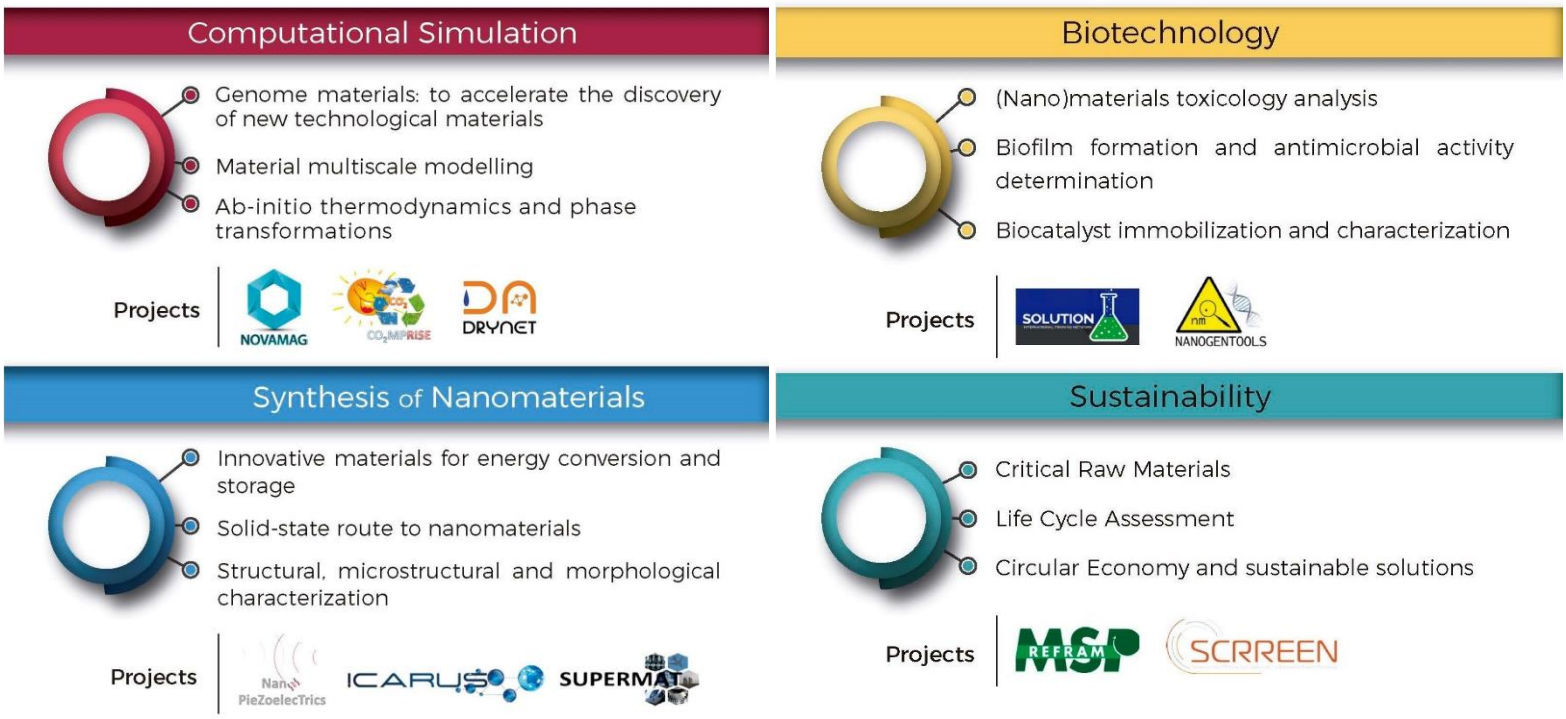
ICCRAM – Universidad de Burgos

ICCRAM (International Research Center in Critical Raw Materials for Advanced Industrial Technologies), established in 2014 as a competence Center of the University of Burgos (Spain) devoted to advanced materials and Critical Raw Materials for advanced industrial technologies, is partly responsible of this success.

This Center, leader in Excellence Science, carries out different researching activities in four principal lines, all of them aimed to the development of new advanced materials: Synthesis of nanomaterials, Computational simulation, Nanosafety and Sustainability. From these lines, ICCRAM approaches different topics of interest at European level (Substitution of Critical Raw Materials, Design of new materials, Biophysics, Biotechnology, Industrial technology, Efficiency resources management, Circular economy and Eco-innovation,...).



ICCRAM has specialist staff from all over Europe, and during the last years ICCRAM has been involved in numerous European Projects funded under the European framework program for Research and Innovation H2020, such as the Excellent Science pillar Marie-Sklodowska Curie Actions (coordinating for instance NANOGENTOOLS Project) or Competitive FET-OPEN, and well as in Industrial Leadership Program (particularly active in NMBP and SC5), related to Circular Economy and Raw Materials.

ICCRAM is a leading actor in international organizations as PROMETIA, European Innovation Partnership on Raw Materials (EIP-RAW MATERIALS), the Nanosafety Cluster or the Association of Nanotechnology Industries, is actively participating in European Projects and recently joined BioNanoNet to foster international cooperation in the nano-toxicology, health and safety areas.

The Center aims to boost and support the industrial development through R&D and knowledge transfer and works hand by hand with the region's industrial pole. ICCRAM also collaborates with City Council of Burgos and regional government of Castilla y León by developing new Circular Economy models to contribute to the sustainability of the territory and improve some objectives:

- Boost and support the industrial development through R&D and Knowledge Transfer.
- Develop new Circular Economy model to contribute to the sustainability of the territory.
- Position the city and the region as demonstrator units of innovative projects in a national and international context, specifically within the framework of H2020.

The young University of Burgos appears for the first time in the World University Ranking 2019. At a national level, it ranks the 23rd position in the "THE" (European Teaching Excellence Rankings). As a reference in the scientific field, the campus of the University of Burgos offers a broad educational and disseminate catalog with great recognition at European level.

Contact:
ICCRAM – Universidad de Burgos
Tel: +34 947 49 20 05
secretaria.iccram@ubu.es
www.ubu.es/iccram

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BioNanoNet *project presentations*

NanoADD - national project on advanced nano-composites in the circular economy of plastics kicked-off

On 21st of November 2018, the national project “NanoAdd” had its kick-off meeting in Vienna, Austria. In the framework of the project "NanoAdd", the role of functional fillers and nanoscale additives for plastics in the circular economy and their impact on the recyclability of the products will be investigated. For this purpose, company surveys on recyclability and specific market shares will be carried out. In addition, industry-specific databases and in-depth interviews with experts will be conducted in order to generate reliable data on the quantities of innovative fillers and additives actually used. These data are in turn the basis for material flow analyses to quantify the importance of innovative additives in the Austrian plastics cycle. In addition, a stakeholder workshop will be conducted to specify certain plastic applications. Finally, the potential positive as well as negative effects of innovative plastic products will be summarized and published.

The project is funded by the Austrian nanoEHS programme, which is initiated and hosted by the Austrian Ministry for Transport, Innovation and Technology, and the Ministry for Sustainability and Tourism.

BioNanoNet is part of the NanoAdd consortium as subcontractor of the University for Natural Resources and Life Sciences, and adds expertise in nanosafety issues along the entire lifecycle and the Safe-by-Design approach.

For further information on the project, please visit the project’s webpage.

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BioNanoNet Member Contributions

Contribution of Graz University of Technology

Crossbreeding as an evolution booster

University of Graz, Graz University of Technology together with an international research team discover new mechanisms of speciation

Cichlids are good examples of how nature is changing. Using a new genomic method, scientists decoded more than 500 selected genes from these animals and were able to explain the rapid development of new species. © Maximilian Wagner

Animals that migrated or have been introduced in Central Europe - such as the Asian bush mosquito or the Asian ladybeetle - feel extremely comfortable in their new homes due to changing climatic conditions. It is possible that some newcomers will crossbreed with native species, provided that they are genetically compatible with a local species, as has happened for example between modern humans and the Neanderthals. After such an event, hybrids will continue to evolve under local environmental conditions. The new genes contributed by the foreign species provide new genetic combinations that can be beneficial and thus favoured by natural selection. Ultimately, this can lead to divergent populations and even new species that possess novel characteristics, in accordance with hybrid swarm theory. To identify the fundamental mechanisms behind this process, an international team of evolutionary biologists working with Professor Christian Sturmbauer at the University of Graz and Professor Axel Meyer at the University of Konstanz studied cichlids from Lake Tanganyika in East Africa.

"The processes underlying speciation are particularly easy to study when using a system such as cichlids, with several hundred endemic species having evolved within the Lake Tanganyika ecosystem", explains Christian Sturmbauer from the Institute of Biology at the University of Graz. To decipher this rapid and therefore difficult-to-explain species emer-

gence, the collaborating researchers were able to sequence more than 500 selected fish genes via cutting-edge genomic sequencing techniques. "Based on our new evolutionary trees, we can now explain why new species sometimes appear in bursts," summarises the evolutionary biologist. The conclusion: even at the beginning of the oldest cichlid radiation, environment-induced hybridization between the colonizer lineages produced innovative forms, which then expanded rapidly under stable conditions, thus "boosting" the speed of innovation and species development. The researchers established that - for Lake Tanganyika - it was a lineage from the Lower Congo River, which no longer occurs independently in today's lake, but could be detected via genetic information in the other diversifying lineages. It is those characteristics that are exposed to selection that are responsible for the development of new species.

In cichlids, some genes - such as those influencing body colouration and specialisation of the jaw - diversified more rapidly and are associated with the colonisation of new lake environments. "It is those characteristics that are exposed to selection that are responsible for the development of new species," explains Sturmbauer. In the case of cichlids, for example, the jaw innovations are crucial and enable the fish to gain access to previously unexploited food sources. “Using our comprehensive methodology, we were able to substantiate this for the first time," said the researcher. The team was also able to shed light on the much-discussed chronology of events relating to cichlid speciation: up until now, studies that have used molecular clock calibrations resulted in ages that were either too young or too old and were generally problematic to reconcile with the geological history of the region. Research findings resulting from the new molecular clock analysis reconciles the split of the southern Gondwana continent with the chronology of the sinking of the East African Rift valley where Lake Tanganyika cichlids evolved together with the maturing ecosystem. "These findings may help us understand, for example, ongoing changes induced by climate change in the animal kingdom," emphasises Sturmbauer.

Contact:

Christian STURMBAUER
Institute of Biology | University of Graz
Tel.: +43 (0) 676 325 - 5080
christian.sturmbauer@uni-graz.at

Gerhard THALLINGER
Institute of Computational Biotechnology
Graz University of Technology
+43 (316) 873 - 5343
gerhard.thallinger@tugraz.at

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Contribution of Graz University of Technology

Temperature measurement for smart production

In the CHIP project, Ceratizit Austria, TU Darmstadt, Material Center Leoben and TU Graz are improving the recording and analysis of heat flows in milling machining. With sensational results.

“What is sensational about our project can be found hidden away in this rather inconspicuous chart,” says Franz Haas from the Institute of Production Engineering as he points to a diagram reproducing a saw-toothed temperature progression for the period of a tenth of a second (Figure 2). The cutting temperature resulting from milling a titanium alloy (Ti64) was measured on the cutting edge. The sampling frequency necessary for this amounts to 20 kHz and was only possible due to a piece of hardware developed by the Institute. In other words: 20,000 temperature values are captured and processed in 1 second. The method developed at TU Graz is thus twelve times more accurate than the best system currently available on the market for process data acquisition during milling, which has maximum sampling rate of 1.6 kHz. It is extremely important to know the temperature development of some materials during processing: for instance, in titanium alloys, which are used in lightweight construction, and also in carbon-fibre reinforced polymers (CFRP). CRFP materials frequently find application in the aerospace industry due to the fact that they offer maximum stiffness at minimum weight. One risk involved in their processing is that the high temperatures can damage the matrix, thus destroying the material-composite structure. This can lead to sudden fragmentation when subjected to stress at a later stage or to a fracture of the included materials as a result of a delamination of the structure. For this reason, it is extremely important not to exceed the material-dependent temperature limits during milling. “Whereas measurements have returned an average value of the occurring temperature fluctuations, our high-resolution method also allows temperature peaks during processing to be recognised even at the individual teeth of the tool,” explains Franz Haas.

Darmstadt, Reutte, Leoben, Graz

The name of the research project CHIP stands for Competence Through Highly Intelligent Production with a unique Temperature Sensor in Milling Tools”. “A chip is of course a waste product from milling, but the name of the project also hints at the electronic we’re developing,” says Franz Haas. TU Graz is working on the CHIP project together with the Institute of Production Management, Technology and Machine Tools at TU Darmstadt and the K2-centre Materials Center Leoben. The operator and consortium manager of the Austrian Research Promotion Agency (FFG) funded pro-

ject is the Ceratizit Group. The affiliated company of the Tyrolean Plansee AG specialises in cutting tools and hard-metal solutions for precision processing of a wide range of materials.

“Collaboration with the company and the research partners is running very well,” reports Haas. The project team meets up four times a year to exchange preliminary results and to talk about the next steps. Meetings take place alternately in Darmstadt, Reutte, Leoben and Graz. “The last meeting took place in Reutte. The meetings are always very productive, and take place on a personal level.”

Data volume and practical knowledge

For Franz Haas, exchanging practical knowledge on a personal level is at risk from missing out against the background of Big Data. It’s surprising to hear a technology professor talk like this, someone at whose institute a measuring method is being improved, when he says as an aside: “In the field of production processes there is a lot of know-how which is not written down. This practical knowledge, this knowledge which you can’t look up, is something very valuable that should be understood as an essential treasure for every company and made digitally useful.”

But back to the CHIP project. The experimental set-up, the development of the prototype and especially the attachment of only 0.25mm¬thick thermoelements in specially prefabricated milling tools were mechatronically very challenging. The experiments were led by the young Chinese technologist Wenqi Liu, a mechatronics graduate from Johannes Kepler University Linz, who has been working on her doctoral thesis at TU Graz in the context of the project for almost two years. In Haas’s view, the innovation of CHIP lies in its interdisciplinary approach: namely, in the cross¬over between mechanics, electronics and software. “Through better electronics, measurement and control technology, a huge improvement potential is opening up with respect to applications in production technology,” says the production technology professor. “The interim results of the present project will allow us to design milling and other production processes more efficiently in the spirit of machine learning. This is particularly important for quality assurance when you’re processing temperature-sensitive materials. The challenge now is to develop an algorithm by which one can filter results out of the mass of data which can lead to concrete improvements of the tool, in machine and product quality.”

Contact:
TU Graz, Institute of Production Engineering
Franz HAAS
Phone: +43 316 873 7170
franz.haas@tugraz.at

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Contribution of Graz University of Technology

Rerouting the function of the hand

The MoreGrasp project is coming to an end and has provided substantial results. The mental control of neuroprostheses can be considerably simplified in the future with the help of reprocessed brain signals.

Marcel is paralysed and can only partially move his arms and legs. He cannot grasp glasses and needs support to eat. “The common assumption is that you cannot do anything more for someone in such a case, and that tetraplegia is an immutable fact,” explains Gernot Müller-Putz from TU Graz’s Institute of Neural Engineering. “But it doesn’t have to be like that.” He wants to help people like Marcel to have more quality of life and independence.

Brain-Computer interfaces

Gernot Müller-Putz conducts research on brain-computer interfaces or BCI. These interfaces can translate brain waves measured by an electroencephalogram (EEG) into computer commands, which in turn can control a neuroprosthesis. “In tetraplegia all the circuits in the brain and muscles in the body parts concerned are still intact, only the neurological connection between the brain and the limbs is interrupted. We bypass this by communicating via a computer which in turn passes on the command to the muscles,” explains the professor. The muscles are triggered and their movement stimulated by means of electrodes fastened to the outside of the arm, thus eliciting, for example, opening and closing of the fingers.

Up to now we work using a mental rerouting to generate distinct signals to control the prosthesis. The test persons thought about lifting and lowering a foot and the mental signal measured by the EEG opened the right hand. When they thought of a movement of the left hand, the right hand closes again. Whatever thoughts that were assigned to the respective movement were irrelevant: what was important was the sufficient distinguishability of the produced brain waves.

The team in Graz developed this technique further in cooperation with the University of Heidelberg, KnowCenter, University of Glasgow and partners Bit Brain Technologies and MEDEL in the recently concluded project MoreGrasp financed by the EU and created a paradigm shift. This mental “rerouting” is no longer necessary, as Müller-Putz explains: “We

now use so-called ‘attempted movement’.” The test person attempts to carry out a movement, for instance to grasp a glass of water. Due to tetraplegia, the occurring brain signal is not passed on, but can be measured using an EEG and processed by the computer system. A variety of grips were investigated in the project: the palmar grip (cylinder grip, grasping a glass), the lateral grip (key grip, picking up a spoon), and opening the hand and turning it inwards and outwards.

A test person is training with a software especially designed for the MoreGrasp-project.

“There is very little difference between the signal of grasping a glass and opening the fingers afterwards. But we are figuring out these differences and using them to directly trigger the neuroprostheses. We recognised that this research field is still in its infancy, but we’ve introduced these signals and thus made an important step,” says a delighted Müller-Putz. This is a completely new possibility and could be a game-changer for users.

Large-scale study

A special online platform to link up interested persons and those concerned was set up in the course of the project. End users can register on the platform to enter a large¬scale feasibility study which is intended to check compatibility in everyday life of the technique developed in the study. “Following this, we will test the motoric abilities of all the participants who are eligible for our study using a specially developed toolkit. In doing this, we will look at EEG patterns, test whether the muscles can be triggered using electrical stimulation, and make a complete assessment of all available muscle power and degrees of movement,” explains Müller-Putz. Afterwards, each test person will be provided with a tailormade BCI training course which must be completed independently in sessions lasting several hours each week. In this way brain signals will be gathered and the system will learn during each experiment.

The first grip

In addition to the groundbreaking research, Müller-Putz and his team are very involved in creating awareness of it. Just before the project started, the first outpatients department in Europe specialising in neuroprostheses was opened in Heidelberg. And there is increasing interest in the topic from other doctors: “As I already said, up to now people were of the opinion that tetraplegia was an open and shut case. But we are slowly realising that it doesn’t have to be.” But the research is an important step in particular for the people concerned, explains Müller-Putz, with barely concealed joy on his face: “When they can suddenly move their hands again after so many years, it’s fantastic for them. This grin that they have: you just can’t describe it.”

Contact:
TU Graz, Institute of Neural Engineering
Gernot MÜLLER-PUTZ
Phone: +43 316 873 30700
gernot.mueller@tugraz.at

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Contribution of Graz University of Technology

The world of gas bubbles and liquid drops

Günter Brenn investigates the behaviour of gas bubbles and liquid drops. His work is especially important in process engineering.

Gas bubbles rise in a drink. A process as beautiful as it is familiar. Sometimes we notice, but we rarely think about it. But Günter Brenn from TU Graz's Institute of Fluid Mechanics and Heat Transfer does. In brief, he investigates the motion of gas bubbles in liquids (for example in bioreactors and drinks) and the formation of drops of liquid in gases (for instance in the production of sprays in process engineering and combustion engine technology). But the detailed explanation is a little bit more complex.

We are surrounded by gases and liquids. And how exactly they behave is investigated in the research field of fluid dynamics. This field is subdivided into aerodynamics, i.e. the science of the motion of air, and hydrodynamics, for the behaviour of liquid materials. Liquid materials can be Newtonian or non-Newtonian, and each of them has a different respective dynamic behaviour. The behaviour of Newtonian liquids, as for example water, can be described using a simple material law. For non-Newtonian liquids, as for example viscoelastic liquids, the material law is more complicated. These liquids change their material behaviour under the action of forces: some of these liquids become thinner, whereas others become thicker. If the force is exerted slowly, then some non-Newtonian materials behave like liquids, whereas, if the force is exerted more quickly, they behave like solids. Examples of viscoelastic liquids are blood and gels, but also solutions of polymers and proteins.

Materials with viscoelastic properties occur frequently in bio-process engineering. To bring about reactions in these liquids, for instance by means of bacteria or algae, the liquids are aerated with oxygen. The success of these reactions essentially depends on how long the gas bubbles remain in the liquid before leaving it. This residence time of the gas bubbles depends on their rise velocity and on the depth of the liquid bath. 'On the one hand, it is exactly these kinds of bubble processes we are investigating – in other words how gas bubbles behave in viscoelastic liquids,' says Günter Brenn, explaining his work. 'But we also deal with exactly the opposite. In other words, how drops of liquid behave in a gaseous

environment, as is the case in atomisation processes in the formation of sprays, for example.

Important questions in fluid dynamics

In principle, gas bubbles rise in a liquid at a certain constant velocity – as we can easily observe in our glasses of drinks. The actual velocity depends on the volume of the bubble: the bigger the bubble, the faster it rises. But this is quite different in viscoelastic liquids. If the volume of a gas bubble exceeds a particular threshold value in some viscoelastic liquids, it rises disproportionately much faster than a bubble with a slightly smaller volume below the threshold. ‘We don’t know exactly why this is so yet, but we have a model in mind that we want to test. Of course, we have a fundamental interest in this – we want to find an explanation for this phenomenon in the interest of basic research,’ justifies Günter Brenn. ‘But such findings are of course very valuable in process engineering’. The aim is to predict the behaviour of one respective material in another, to characterise the respective liquids correctly on the basis of these findings, and finally to use them successfully.

Experiments in the labs at Campus Inffeldgasse

It is mainly experimental work that is carried out in these research areas under Günter Brenn. Test rigs are available in his laboratory on the ground floor of TU Graz’s Institute of Fluid Mechanics and Heat Transfer at Campus Inffeldgasse, as Brenn explains: ‘We systematically produce gas bubbles which we allow to rise in liquids, and we measure this process accurately. And we do this in the same way with atomisation processes. We spray the liquid into the air under controlled conditions and measure the propagation and the size of the drops.

Contact:

TU Graz, Institute of Fluid Mechanics and Heat Transfer
Günter BRENN
Phone: +43 316 873 7340
guenter.brenn@tugraz.at

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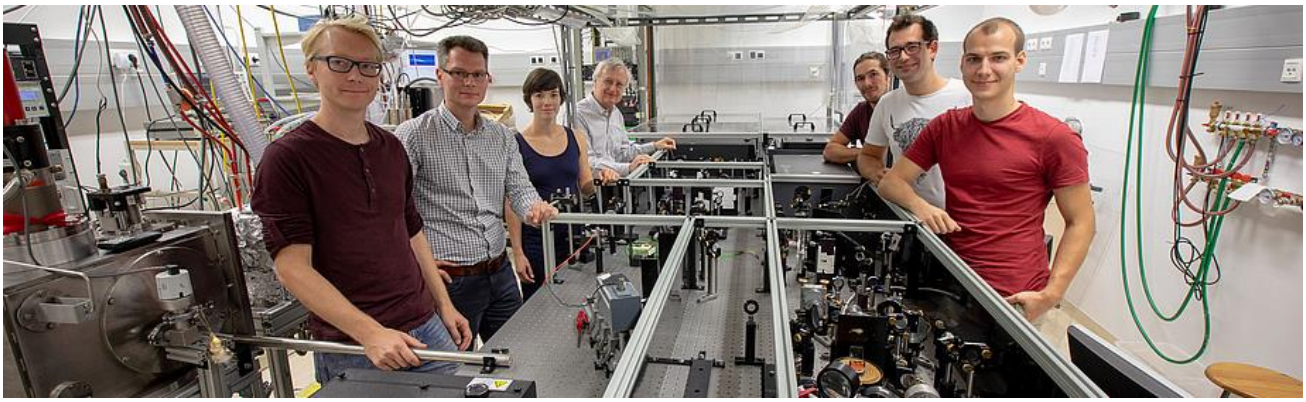
Contribution of Graz University of Technology

Breakthrough in quantum physics: reaction of a quantum fluid of photoexcitation of dissolved particles

Researchers from TU Graz have described for the first time the dynamics which takes place within a trillionth of a second after photoexcitation of a single atom inside a superfluid helium nanodroplet.



Markus Koch, Wolfgang Ernst, Bernhard Thaler and the team at the Institute of Experimental Physics achieved a breakthrough in the research of completely novel molecular systems (© Lunghammer - TU Graz)

In his research, Markus Koch, Associate Professor at the Institute of Experimental Physics of Graz University of Technology (TU Graz), concentrates on processes in molecules and clusters which take place on time scales of picoseconds (10^{-12} seconds) and femtoseconds (10^{-15} seconds). Now Koch and his team have achieved a breakthrough in the research on novel molecular systems. By means of femtosecond spectroscopy, which allows ultrafast processes to be measured in a time-resolved way, the TU Graz-researchers were able to exactly describe the processes in an approximately five-nanometer sized superfluid helium droplet after photoexcitation of an atom inside. This milestone in basic research has impact on the experimental investigation of atoms and molecules. Markus Koch explains the pioneering approach: “Our institute, headed by Wolfgang Ernst, has a long tradition in the production and investigation of novel systems and clusters in a nanometer-sized quantum fluid. We are now combining this expertise with femtosecond spectroscopy. This allows us to observe and measure processes, which are triggered by photoexcitation in real time and to describe their dynamics. We are the first research group who has observed this.” The results of the research have just been published in Nature Communications.

A technique rich in superlatives

To investigate this fundamental process which takes place on an ultrashort timescale of only one trillionth of a second, the team led by Markus Koch applies femtosecond spectroscopy. The femtosecond pump-probe method provides snapshots of atomic movements. For the experiment, a single indium atom is introduced into a tiny helium droplet. The indium atom is subjected to pump excitation by means of a short pulse and subsequently transfers energy to the surrounding helium, which starts to oscillate collectively. A time-delayed second flash of light then probes the system in order to observe the dynamics. Bernhard Thaler, a PhD student at the Institute of Experimental Physics who is substantially involved in the pathbreaking research, explains what happens: “When we photoexcite the atom inside the helium droplet, its electron shell expands and the enveloping bubble increases within a picosecond after stimulation. We further observe that the indium atom is ejected from the droplet after about 50 to 60 picoseconds. We were able to obtain this mechanistic insight for the first time with the femtosecond experiment.” A process characterised by superlatives: ultrafast movements on femtosecond timescales inside nanometer-sized helium droplets (which is less than one thousandth of the diameter of a hair) at an ultralow temperature of 0.4 Kelvin above absolute zero. The team was able to illustrate this process very clearly using simulation software. A short video was first published in Nature Communications 9 (2018). Link to video.

From proof of concept to application in complex molecules

With this research success, Markus Koch and his team managed to prove impressively that the ultrafast, electronic and nuclear dynamics of particles inside superfluid helium droplets can be observed and simulated. Following this research success, Markus Koch is already looking into the future. “Today, we are still experimenting with single atoms,” says Koch, “but after this proof of concept we are moving in giant steps towards the application of helium nanodroplets to investigate dynamics in previously unknown or fragile molecular systems of technological or biological relevance.”

Contact:
TU Graz, Institute of Experimental Physics
Markus KOCH
Tel: +43 316 873 8161
markus.koch@tugraz.at

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Contribution of PAYER Medical Group

Microfluidic by PAYER Medical

Innovative power and cooperation pay off

70 years of experience, competences in conception, development, tool making, plastics and metal processing, assembling as well as continuous learning represent the PAYER Group. PAYER is able to offer its customers a perfect realization of innovative product ideas. The company operates in various business segments, like Personal Care, Baby and Child, Sports and **Medical**.

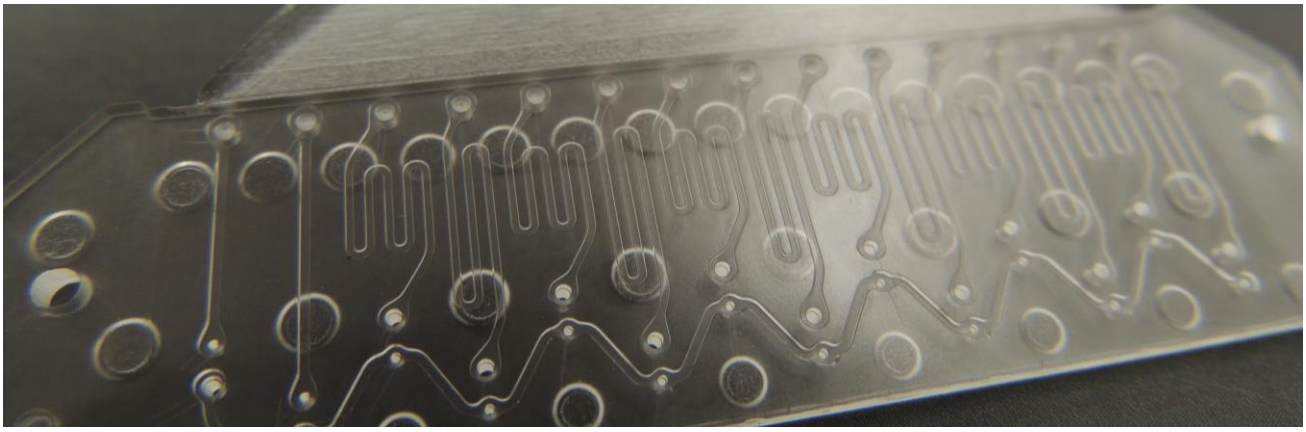
PAYER's headquarters are in Reiteregg, Austria, with production sites in Hungary and China. This global structure enables flexibility and efficiency. The Austrian site accompanies the whole process for **medical products,** from the conception to the industrialization of the products.

© PAYER Medical Group

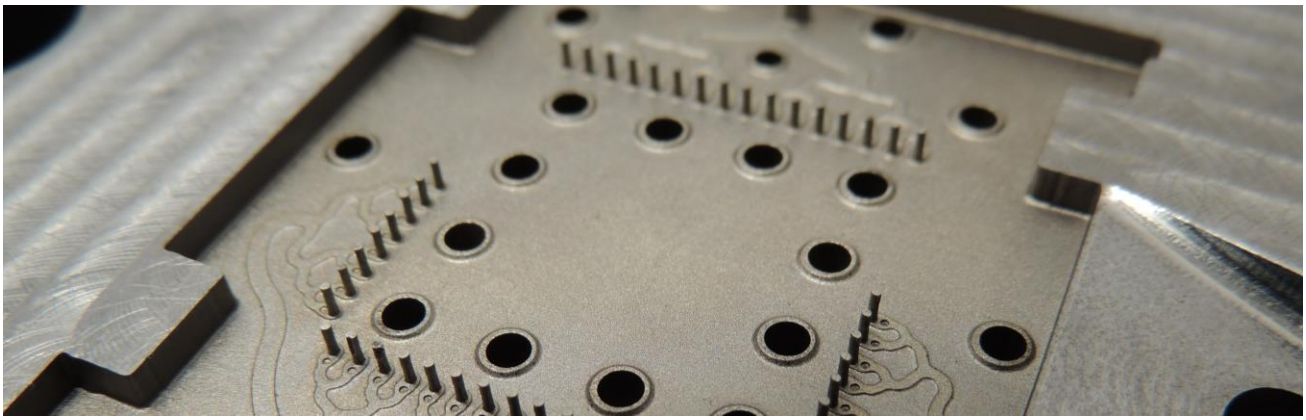
Three years ago, PAYER started to develop microfluidic chips for tissue staining in close collaboration with a Swiss start-up business. The aim was to shorten the tissue staining process and to enhance the outcome by minimizing undefined results.

After a successful joint development, PAYER made tools by its rapid tooling process in order to reduce the time-to-market as well as to achieve a significant cost reduction for the customer. The challenge in the product realization was the injection molding of the microfluidic structured chip in combination with the small through holes (0,2 mm), which allow the fluid to change layer in the mounted chip.

The key factors of success were the tooling, the injection molding and the assembling process. PAYER designed and built the tools, which set new standards. The assembling process included a special bonding process and a newly developed testing method ensured the expected quality. After positive evaluation of clinical pilot studies, the series production within the last eight months became possible, including the validation. The tools from the rapid tooling process have been upgraded to serial production tools, which enable an efficient scale up for market entrance. In future, the target is to make tissue staining as simple as brewing coffee within a capsule filling machine.



Example product: Microfluidic chip *© PAYER Medical Group*



Example tool: Part of the microfluidic chip tool *© PAYER Medical Group*

Contact:
PAYER Medical GmbH
René Zengerer, Head of Engineering at PAYER Medical GmbH
Tel: +43 3123 2881 0
rene.zengerer@payergroup.com
www.payergroup.com

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Contribution of Science Consult DI Thomas Mohr KG

Science Consult

OMICs databases for biomarker discovery? Let's utilize them!

Magdalena Hübner[1] and Thomas Mohr[1,2,3]

(1) ScienceConsult – DI Thomas Mohr KG, Enzianweg 10a, 2353 Guntramsdorf Austria
(2) Institute for Cancer Research, Medical University of Vienna, Vienna
(3) corresponding author: thomas.mohr@mohrkeg.co.at

Introduction, Rationale & Challenge

During the last years, data sharing via OMICS databases such as ArrayExpress, PRIDE, ProteomeXchange or the Gene Expression Omnibus has become more and more common. As of today, ArrayExpress houses 47.65 TB of data, translating into 2.3 million assays. Assuming costs of €400 per sample (treatment and processing), this translates into a value of nearlyone billion Euro – for ArrayExpress alone. A search with the keyword "nanoparticles" yields 99 experiments containing over thousand assays in various species. The same search in the Sequence Read Archive yields over 1000 entries.

The challenge of utilizing these databases to investigate biologic effects of a treatment, e.g. nanoparticles, *in silico* remains high. Primary obstacles are differing experimental designs, cell lines, techniques etc. that often prevent direct data pooling and reanalysis. However, cost savings by utilizing databases to direct research can be substantial. In our case study to find potential biomarkers for bronchial epithelial cell activation by particulate matter (PM10, PM2.5, and nanoparticles) we started with 5 datasets containing over 150 assays, including gene expression profiles from human subjects (healthy, asthmatics, allergics and asthmatoallergics). RNA extraction, hybridization and scanning alone would have cost €45.000 (assuming €300 per array).

A general methodology is outlined in Figures 1 and 2. Briefly, an extensive database research is done to identify potentially useful datasets. The search strategy should follow a narrow-down path which results in an initially large set of data which is narrowed down according to the specific requirements of the desired analysis. Following data collection, a rigorous outlier exclusion is applied. This step is followed by a determination of differentially expressed genes by industry standard methods such as Linear Model analysis of MicroArrays (LIMMA). For biomarker detection we focus on upregulated genes, since gene downregulation is difficult to interpret in the context of cell state changes. Studies may be combined at different levels, namely at the expression level of genes by developing a meta measure for gene expression or at a later level by for instance combining p-values via meta-analysis methods. This approach leads to a robust, study and pre-processing method independent detection of biomarkers and associated biological processes.

Case Study – developing robust biomarkers to assess biological efficacy of air filters.

Clean air is regarded as a fundamental need to ensure human health and well-being. Air pollution constitutes an increasing threat to health worldwide, and epidemiological evidence on the health effects of air pollution is growing quickly. Ambient particulate matter (PM) and household air pollution are among the ten leading risk factors contributing to the global burden of diseases, as was estimated by The Global Burden of Diseases, Injuries, and Risk Factors Study 2015. In 2016, 8 million people died worldwide from effects of air pollution (WHO). The contribution of outdoor and indoor air pollution was estimated to be 4.2 million and 3.8 million deaths, respectively.

Many diseases of the respiratory tract are caused or worsened by an inflammation of the lung tissue. Of all air pollutants, particulate matter (PM) has the strongest association with adverse health effects Nanoparticles with an AED of <0.1µm, travel by diffusion rather than sedimentation and behave almost like gas molecules. They can invade the alveoli where gas exchange occurs and even translocate into the bloodstream, which is why they are often found in remote organs.

Existing tests for filter efficacy are based on particle size. Biologic activity of the filtrate, however, is not assessed so far. However, particles of the same size vary greatly in their chemical composition and noxiousness. Therefore, the assessment of biologic activity becomes more and more important, since even low particle counts of biologically active particles may exert a large effect.

Our project aimed at developing an *in vitro* test system that allows ELISA or proteomics-based assessment of the biologic activity of particulate matter.

The computational part of this project dealt with:

- Statistical analysis of single experiments (Figure 1 left).
- Meta-analysis for marker selection (Figure 1 right).
- System biology: setting the results of the meta-analysis into a biological context by looking at involved biological pathways and functions using Gene Set Enrichment Analysis

Meta-analysis resulted in the identification of several biomarkers for particulate matter of various sizes (Figure 2).

The found biomarkers are currently validated by ELISA and proteomics by choosing

- an appropriate cell line
- an appropriate SOP
- an appropriate ELSIA/proteomics approach.

With the establishment of publicly accessible omics databases, broad access to a wide selection of data has become easy. The general picture of gene expression associated with cell states that -omics data provide enables researchers to move from “educated guess” approaches to knowledge-based study design in order to discover biomarkers, therapeutic targets or to investigate the biologic effect of materials.

As an additional benefit, utilization of -omics data has a considerable impact on reduced project costs. In our case, gaining data from human subjects would have necessitated the cooperation with a major hospital, resulting in considerable costs for carrying out a micro clinical study. Even with the restriction to *in vitro* testing, costs for array experiments would have been considerable.

In conclusion it can be said, that in depth utilization of publicly available -omics databases at any stage of a molecular biology project greatly facilitates hypothesis generation and testing. It leads to a much more targeted and cost effective approach in any research project that involves molecular biology.

The project (EUREKA ID 9915) was carried out in cooperation with Freudenberg Filter Technologies (Weinheim, Germany), the OFI InnovationsGmbH (Vienna, Austria), the Medical University of Vienna, and the University of Life Scences and Natural Resources (both Vienna Austria). The Austrian part of the Project was financed in part by grants of the Forschungsförderungsgeselschaft der gwerblichen Wirtschaft mbH (FFG, Vienna, Austria).

Figure 1: Left: Workflow of individual experiments analysis: After an initial quality assessment of the input data, erroneous arrays were eliminated and batch effects removed. Differential gene expression analysis was done separately, for up- and once for downregulation using the 'limma' package. Right: Workflow of robust biomarker identification using meta-analysis: Several p-value lists are fed into the meta-analysis pipeline for up- and down-regulated genes separately. Lists are harmonized and p-values combined using an appropriate p-value combination approach.

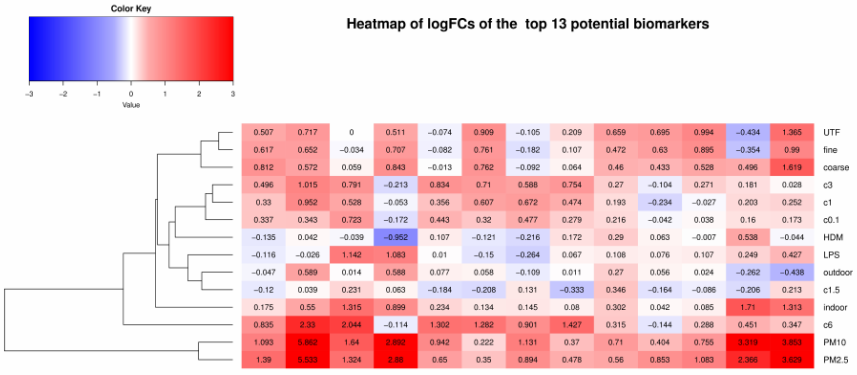

Figure 3. Heatmap of logFCs of the top 13 potential biomarkers: The heatmap illustrates the logFC of each potential gene calculated for each individual contrast (genes shown at the x-axis). The colour key is correlated with the logFCs, with red and blue corresponding to upregulated and downregulated genes, respectively.

Figures taken from Hübner, Magdalena "Robust biomarkers for the cell-based assessment of potentially noxious particulate matter", Master's Thesis at the University of Life Sciences and Natural Resources, manuscript in preparation.

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Contribution of Technische Universität Wien

TECHNISCHE UNIVERSITÄT WIEN

A chip with blood vessels

Bio-chips have been developed at TU Wien (Vienna), on which tissue can be produced and examined. This allows supplying the tissue with different substances in a very controlled way.

Cultivating human cells in the Petri dish is not a big challenge today. Producing artificial tissue, however, permeated by fine blood vessels, is a much more difficult task. Important transport processes in biology, for example the transport of oxygen, sugar and other substances into the tissue, have not yet been fully understood. This is now going to change with a completely new approach to the problem: At the Vienna University of Technology, tissue is being grown on the biochip - so-called "organs-on-a-chip". This allows you to precisely control and measure complicated biological processes - much better than would be possible in animal testing or by experimenting on humans.

Better than animal experiments

"Around a fresh wound, new tissue has to regrow, in which, among other things, new blood vessels form," says Dipl-Ing. Barbara Bachmann of the Institute of Applied Synthetic Chemistry at TU Wien. "We use the body's natural wound healing processes to grow blood vessels in the lab in tiny biochips." For a long time, such research projects relied exclusively on animal experiments. "Animal experiments have many disadvantages - not only from an ethical point of view, but also on a scientific level," says group leader Prof. Peter Ertl. "The results can never be perfectly transferred to humans, and so there are often surprising side effects in clinical trials that never showed up in animal models."

With biochip technology, it is now possible to regulate the substances with which the human vascular cells are supplied with great precision. This makes it possible to cultivate and study human cells over the course of several weeks. "In addition to endothelial cells that line the inside of the vessels, we also use stem cells that play a key role in stabilizing the vascular structures," says Mario Rothbauer. "Almost magically, a network of tiny blood vessels emerges in the biochip within a few days."

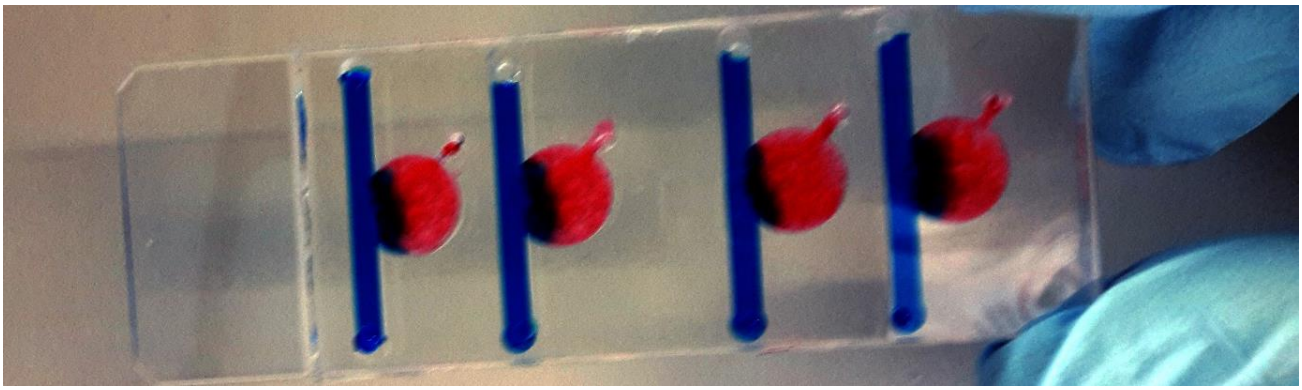
A tiny influx pipe, through which the tissue is supplied with oxygen and nutrients from outside, passes through the tissue next to this newly formed network of fine blood capillaries – it is the "artificial artery" of the biochip. The fine, naturally-grown blood vessels are not directly connected to this artificial conduit, but the boundaries between the two areas are not densely sealed off, so that chemicals can pass through. "This is a situation that is frequently encountered in

medicine," says Prof. Peter Ertl: "For example in wound healing, but also in diseases such as cancer." A fast-growing tumor must find a way to obatin sufficient amounts of nutrients, therefore it usually causes an unnaturally fast growth of fine blood capillaries. This mass transfer between the tumor and the rest of the body can now be investigated much better in the chip. "We were able to show that the supply actually depends on the distance to the influx pipe, as it would be the case in natural tissue," says Dipl.-Ing. Sarah Spitz. "And another crucial finding was that we have been able to show that the nutrient supply to the tissue can be fine-tuned by changing the flow velocity in the biochips - it's that simple."

Interdisciplinary research

In this field of research, several scientific disciplines are closely connected: medicine and chemistry, but also microfluidics (the science of the flow behavior of tiny amounts of liquids), or even material science and manufacturing technology had to be combined to make the precise production of the chips possible. TU Wien collaborated with the Ludwig Boltzmann Institute for Experimental and Clinical Traumatology, and was supported by the "Interreg" funding program of the European Union.

"Only through this interdisciplinary approach can we take on a leading role achieve research results that cause a stir internationally," says Peter Ertl. "Our results show that the bio-chips provide an excellent model to study oxygenation in newly formed tissues. This is just the beginning for us. Remarkable new research opportunities are just opening up."



In any of the four chambers, different conditions can be created, which influence cell growth. (© TU Wien)

Contact:
TU Wien, Institute for Applied Synthetic Chemistry
Prof. Peter Ertl
Tel: +43-1-58801-163605
peter.ertl@tuwien.ac.at

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Contribution of Technische Universität Wien

TECHNISCHE UNIVERSITÄT WIEN

Bioethanol in diesel engines: a contribution to sustainability

Ethanol can make an important contribution to climate protection: at TU Wien, a diesel engine has been developed that can run on over 70% bioethanol.

TU Wien has developed an engine that uses two different types of fuel simultaneously: it uses both bioethanol and diesel, which is used for ignition. A special duel-fuel combustion process has been developed for this purpose, which now enables the use of a large proportion of bioethanol in diesel engines for the very first time. Measurements show that this new technology improves engine efficiency – overall CO_2 emissions have been reduced by up to 39%.

Less fossil fuel, more nature

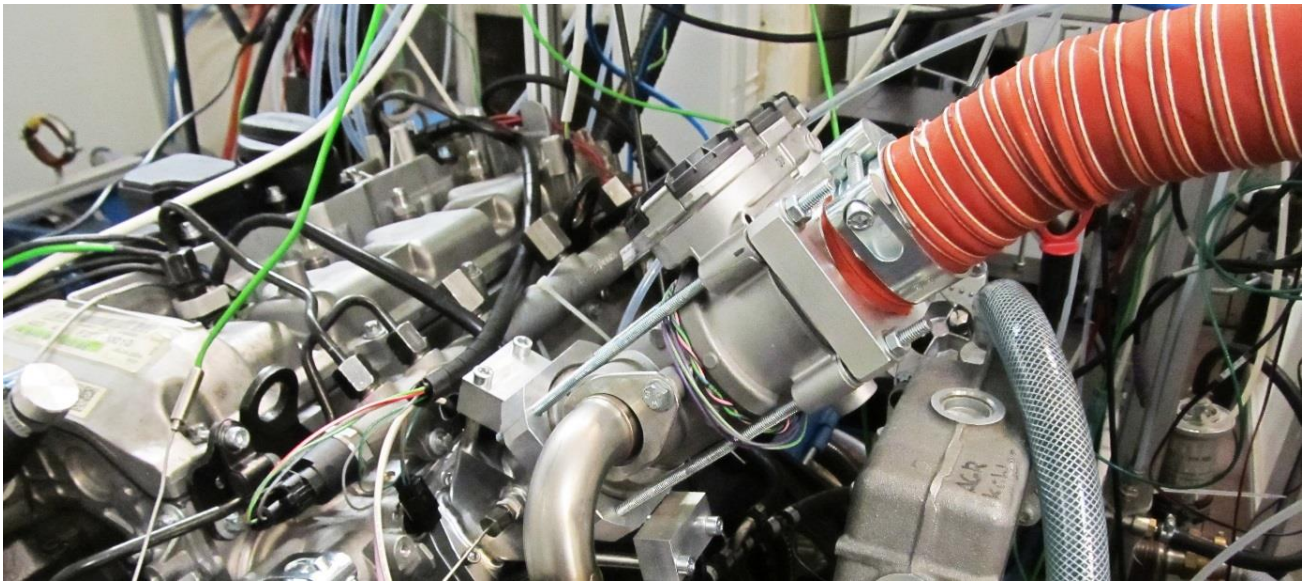
As well as the development of new and more efficient combustion engines, fuel also plays an important role in efforts to reduce the pollutant and greenhouse gas emissions produced by the transport sector. At TU Wien, the use of bioethanol as an additional fuel in diesel engines has been investigated. “In some countries, it has been common practice to add larger quantities of ethanol to petrol for some time. However, until now it has only been possible to do this to a limited extent in diesel engines,” says Prof. Bernhard Geringer from the Institute for Powertrains and Automotive Technology at TU Wien. If you were to simply mix bioethanol into the diesel tank, it would cause problems with ignition. Bernhard Geringer and his team have therefore developed a dual-fuel combustion process. “Ignition is initiated by means of a direct injection of fuel, like in conventional diesel engines,” explains Geringer. “In our model, however, the alcoholic fuel is added to the intake air upstream of the engine. It is then ignited by the diesel ignition. In a manner of speaking, the diesel functions as a spark plug for the bioethanol.”

Less CO_2, less soot, less fine dust pollution

In the tests carried out, the replacement of diesel with the alcohol fuel was gradually increased. These tests showed that up to 70% of the diesel fuel can be replaced with bioeth-

anol – and this even had a positive effect on the efficiency of the engine: “We measured an increase in efficiency of up to 6.1%, and that alone improves the environmental balance of the engine,” says Aleksandar Damyanov (TU Wien). “Of course, we must also consider the fact that bioethanol has an excellent CO_2 balance because it is produced from renewable raw materials. When we factor that in as well, we find that there is an overall reduction in CO_2 emissions of up to 39%.” Various operating points were tested at an engine test bench at TU Wien – from a low engine load to high-load operation, over a speed range of 1500 rpm to 3000 rpm. In all cases, a significant reduction was recorded in the soot mass and quantity of hazardous fine dust particles produced (see table).

“Our results clearly show that bioethanol can be successfully used as a substitute fuel in a dual-fuel diesel engine, and that this concept has significant benefits for the environment,” says Bernhard Geringer. “In many areas, we will not be able to do without diesel engines in the medium to long term – trucks and tractors, for example. E-mobility has its limits here. With our dual-fuel technology, it is possible to significantly improve sustainability and emissions performance in these areas in particular.”



The engine at TU Wien, which runs on bio-ethanol (© TU Wien)

Contact:
TU Wien, Institute for Powertrains and Automotive Technology
Prof. Bernhard Geringer
Tel: +43-1-58801-31500
info@ifa.tuwien.ac.at

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Contribution of Technische Universität Wien

TECHNISCHE UNIVERSITÄT WIEN

Transparent fruit flies

Advances in cellular microscopy: at TU Wien (Vienna), flies were made transparent, so that individual nerve cells, marked with fluorescent molecules, can be examined directly in the animal.

The nervous system of an animal can be studied by cutting it up into thin layers - however this inevitably leads to the destruction of the cellular structures in the tissue. Analyzing complex nerve connections is then hardly possible. The far more elegant method is the so called optical "clearing" of the various tissues using chemical processes that make the animal transparent. Interesting structures in the tissue can be selectively marked and analyzed.

At the Vienna University of Technology, a clearing method has now been developed that can be applied to insects, which is a particularly difficult task. With an improved light-sheet microscope (a so-called ultramicroscope), it is now possible to image large nerve tissue samples and take high-resolution pictures of complex neural networks that have been labeled with fluorescent molecules. The new method has been published in the journal "Nature Communications".

Fluorescent Molecules

"We can learn a lot about the nervous systems of animals by using genetic engineering to insert special molecules into the nerve tissues, which can then be made to fluoresce," says Marko Pende, a PhD student at TU Wien. The big question is how these fluorescent molecules can be imaged without damaging the tissue.

One method that has been used with great success is ultramicroscopy. Transparent tissue is illuminated with a laser beam, which is widened by special optical elements, creating a two-dimensional flat surface of light. This surface penetrates the tissue and illuminates those fluorescent molecules that lie exactly in that plane. Layer by layer, the tissue can be analyzed with this light-sheet, creating a three-dimensional model from the two-dimensional frames on the computer.

"We focused on the fruit fly drosophila melanogaster because it is of particular interest for research into the nervous system. Unfortunately, it is particularly difficult to develop a suitable clearing method for insects, "explains Marko Pende."For the tissue to become transparent, it has to be treated with special chemicals, and in insect tissues these chemicals have always destroyed the fluorescent molecules until now." In addition, insect tissue contains chitin, which can hardly be made transparent. Also, drosophila has particularly robust pigments in it its eyes.

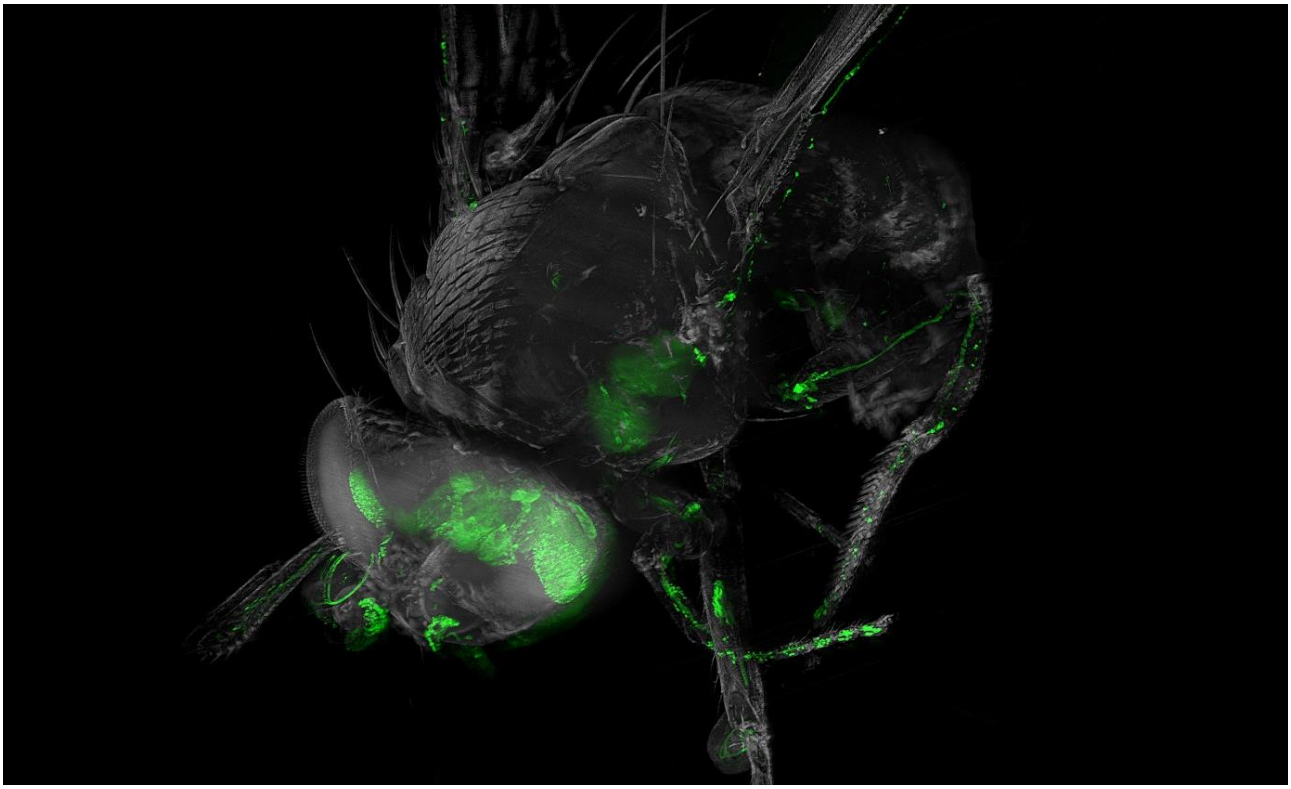
The team at TU Wien (Vienna), together with the University of Vienna and the Medical University, succeeded in finding a way to make drosophila flies completely transparent without destroying the fluorescent marker molecules. This was achieved with the help of improved chemical mixtures. "It is an important step forward for the drosophila research community," says Prof. Thomas Hummel from the Department of Neurobiology (University of Vienna).

The pictures were made possible by pioneering optical research by Saiedeh Saghafi (TU Wien). She was able to significantly improve the ultramicroscope: The light-sheet, with which the plane is illuminated layer by layer, used to be about 10 microns thick. The improved ultramicroscope now produces uniform light-sheets of only 3 µm thickness over a large area. In addition, the microscope was equipped with an additional lens, which changes the focal point, much like to a pair of glasses: "So far, we could only focus on the outer area of the tissue, now we can take a centimeter-deep look into the tissue and still get sharp images," says Prof. Hans Ulrich Dodt, Head of the Department of Bioelectronics (TU Wien). "It will enable impressive, high-resolution images that will give us important insights into the way the Drosophila nervous system works."

The Connectome and Fruit Fly Behavior

The new technique should now help to study the so-called "connectome" of drosophila. The connectome is the arrangement of interconnections throughout the nervous system, the "electrical circuit diagram" of the animal. This circuit diagram can then be related to behavioral patterns of drosophila.

In addition, drosophila is ideal for analyzing genes that lead to neurodegenerative diseases in humans, such as Alzheimer's and Parkinson's disease. Transparent flies now provide a unique opportunity to understand the complex changes in various areas of the nervous system during neurodegeneration.



Ultramicroscopy: Brain and optial system of drosophila melanogaster. *(© TU Wien | Marko Pende)*

Contact:
Center for Brain Research - TU Wien, MedUni Vienna
Marko Pende, MSc
Tel: 0140160-34313
marko.pende@tuwien.ac.at

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Contribution of UCD School of Physics

SmartNanoTox

SmartNanoTox (Smart Tools for Gauging Nano Hazards) is a EU Horizon 2020 project, funded within the research and innovation programme "NMBP-29-2015: Increasing the capacity to perform nano-safety assessment". This 48-months long research programme is supported with ca. 8 Mio Euro and involves 12 partners from 9 EU countries.

Nanotechnology, a fast growing technological field, is affecting EU citizens due to its numerous applications in all aspects of human and societal life including industrial, manufacturing, agricultural, food, and medicinal sectors. Thousands of nanomaterials are already on the consumer market, and in many cases, the risks of personal or environmental exposure to these materials are unknown or poorly understood. A definitive conclusion about the dangers associated with human or animal exposure to a particular nanomaterial can currently be made upon complex and costly procedures including complete nanomaterial characterisation with consequent careful and well-controlled in vivo experiments. In recent years, a great amount of nanotoxicological data has been generated for NMs using *in vitro* and in vivo models, and complemented with vast amount of nanomaterial characterisation data. Still, due to lack of understanding of the mechanism of action of nanomaterials while in human body, a prediction of the potential risks from the nanomaterials' physicochemical properties alone is not possible.

SmartNanoTox team proposed a radical change of the toxicity assessment paradigm via **mechanism-aware toxicity screening**. This will be achieved implementing modern approaches based on one hand on systems biology, on another hand on statistical and other computational methods of analysis of bionano interactions. In particular, SmartNanoTox programme includes *in vivo*, *in vitro* and *in silico* research, which addresses main respiratory toxicity pathways for representative set of nanomaterials, to identify the mechanistic key events of the pathways and relate them to interactions at bionano interface via careful post-uptake nanoparticle characterisation and molecular modelling. The analysis of the biological responses is performed using the language of Adverse Outcome Pathways – AOPs (e.g. addressing lung cancer, fibrosis, asbestosis, or nanomaterial-induced cardiovascular dis-

eases), where Molecular Initiating Events and Key Events are identified and used as novel endpoint for predictive toxicological models.

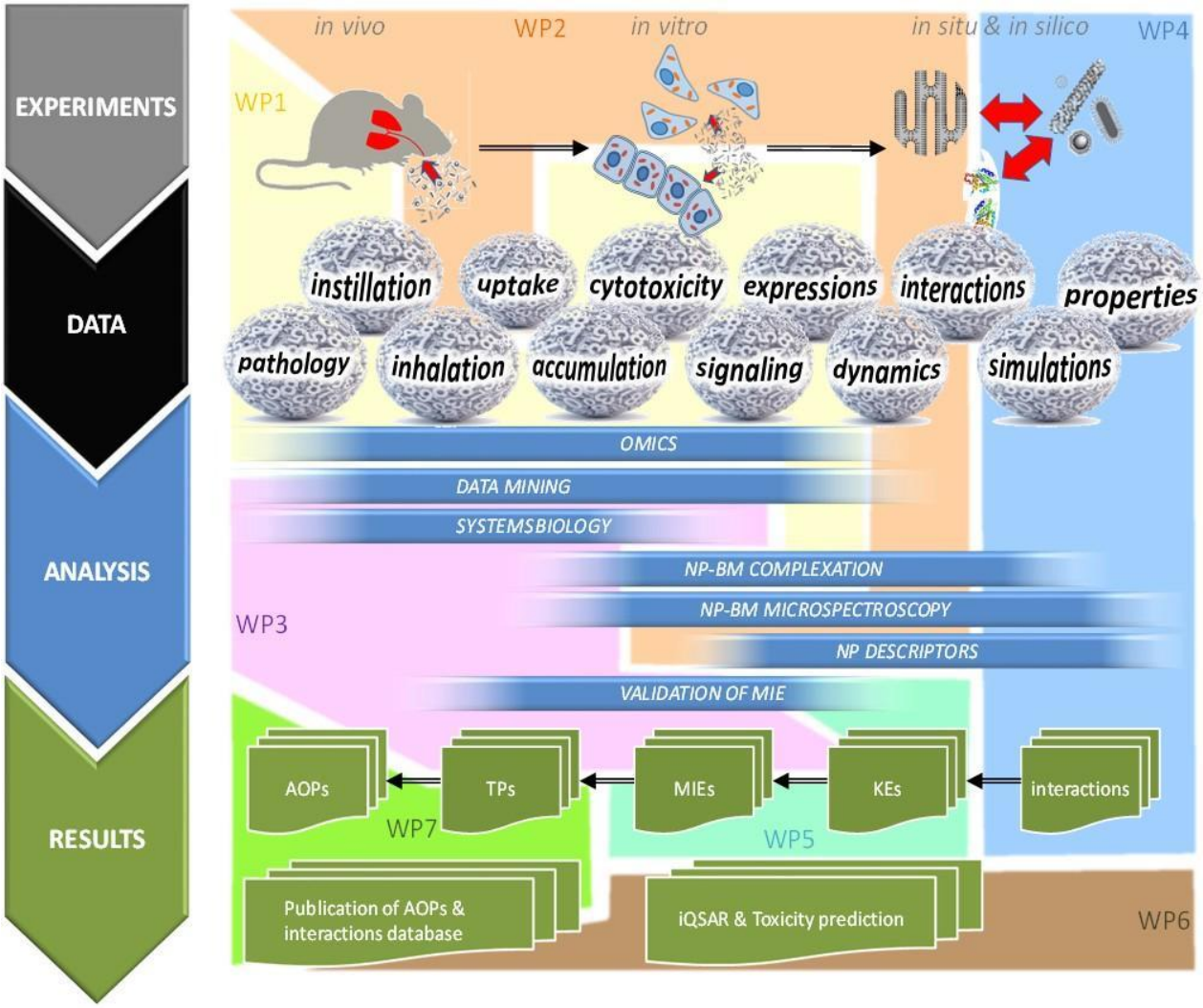
By 2020, the project team aims to deliver a set of respiratory AOPs, a variety of methods of post-uptake nanomaterial characterisation, a database of bionano interactions, as well as *in vitro* and *in silico* tests for cost-effective prediction of the Key Events of these AOPs. Other projected outcomes include methods of nanomaterial labelling and detection, advanced Air-Liquid Interface exposure systems, software tools for analysis of omics data and gene regulation networks, multiscale materials modelling tools and intelligent QSARs for predicting nanotoxicity.

The project team includes experts in workplace and environmental safety, inhalation exposure, biological imaging, histology, systems biology, biophysics, materials and statistical modelling. The project team is interacting with ECHA and OECD WPMN NanoAOP working group, as well as with several other EU projects: NanoTox-Class, NanoCommons, Patrols. By December 2018, SmartNanoTox has published 28 papers on the performed research, and held 2 consortium meetings.

The project is coordinated by Prof. Vladimir Lobaskin, UCD School of Physics, member of BioNanoNet. Further information about the SmartNanoTox project, updates on developments can be found here www.smartnanotox.eu.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 686098

Consortium meeting of SmartNanoTox in Bohinj, Slovenia, March 2018



Outline of the concept and approach. Abbreviations used: WP – work package, BM – biomolecule, NP – nanoparticle, AOP – adverse outcome pathway

Contact:
University College Dublin (UCD)
Dr. Vladimir Lobaskin
Tel: 00353 1 716 24 32
vladimir.lobaskin@ucd.ie
www.ucd.ie

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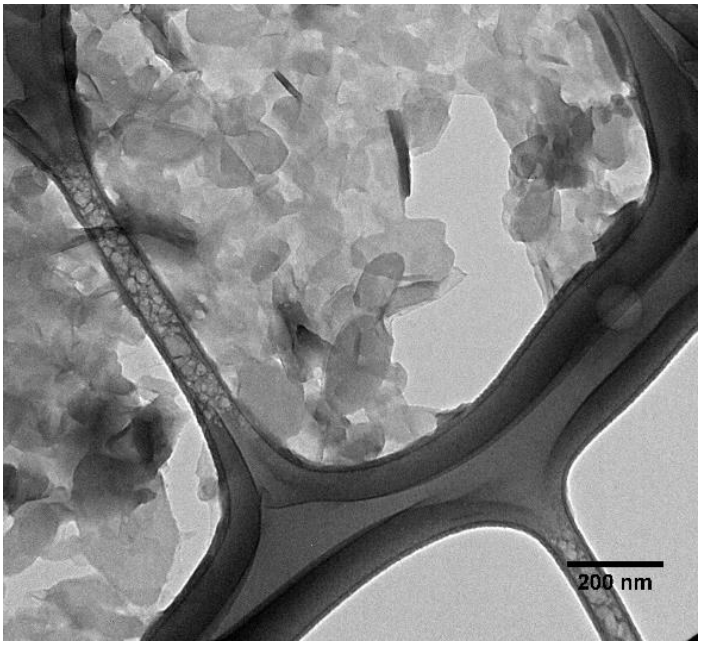
Contribution of ICCRAM – University of Burgos

ICCRAM studies biomolecule-graphene interactions and their industrial and nanosafety implications



NIA Member ICCRAM, a competence Center of the University of Burgos (Spain) devoted to advanced materials and Critical Raw Materials for advanced industrial technologies, performs research on the interaction between graphene nanoparticles and biomolecules, their possible industrial applications and the nanosafety implications related to the high reactivity of these materials.

The modification of carbon nanomaterials with biological molecules paves the way toward their use in biomedical and biotechnological applications, such as next-generation biocatalytic processes, development of biosensors, implantable electronic devices, or drug delivery. One application that has received the attention of academic researchers and industry is the immobilization of enzymes on solid carriers, since it leads to several benefits for biocatalysis, including an efficient recovery and separation of the reaction product. A recent study performed at ICCRAM (ACS Appl. Mater. Interfaces 2018, 10, 18170−18182; DOI:10.1021/acsami.7b18844) has unveiled the ability of different graphene derivatives to modulate the catalytic properties and stability of commercial enzymes after their immobilization, giving the possibility of reutilization of the biocatalyst, increasing the cost efficiency of transformation processes and enhancing the safety of the material handling.

The subject of graphene nanoparticles-biomolecules interaction from the nanosafety point of view is also being tackled by ICCRAM through the coordination of the H2020 European project NANOGENTOOLS, where new methodologies for the identification and control of hazards associated with nanomaterials to ensure consumer and Society safety, are being developed. NANOGENTOOLS combines multidisciplinary scientific approaches (chemoinformatics, molecular modelling, biochemistry, high resolution microscopy, spectroscopy, systems biology, etc.) to develop fast in vitro high throughput (HTS) assays, with molecular based computational models for better understanding of the molecular fundamentals of nanotoxicity.

Contact:

ICCRAM – Universidad de Burgos
International Research Center in CRMs for Advanced Industrial Technologies (Burgos, SPAIN)
Sonia Martel Martín
Phone: (+34) 947499113
smartel@ubu.es

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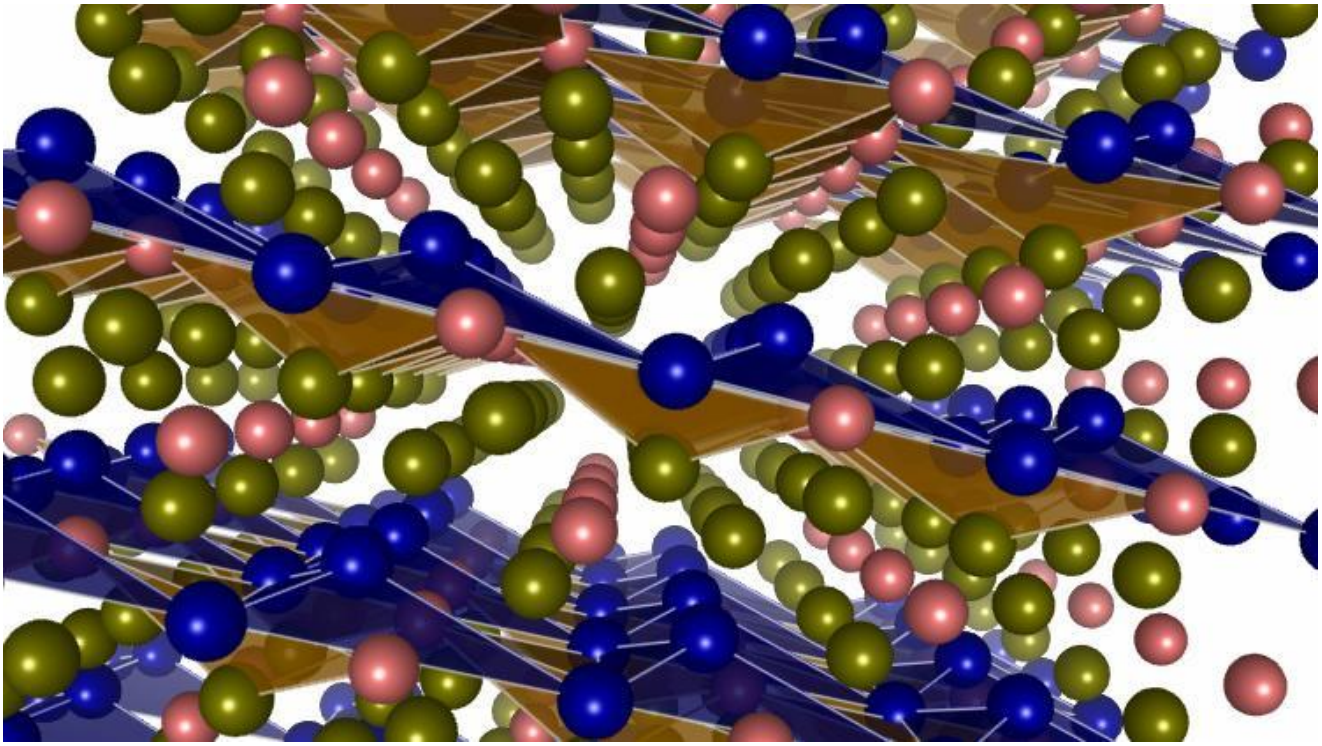
Contribution of ICCRAM – University of Burgos

UNIVERSIDAD DE BURGOS | ICCRAM

ICCRAM studies new rare-earth free permanent magnets



NIA Member ICCRAM, a competence Center of the University of Burgos (Spain) devoted to advanced materials and Critical Raw Materials for advanced industrial technologies, searches for new Rare-Earth Free Permanent Magnets by using high-throughput computational approaches based on Genetic Algorithms.

Nowadays, permanent magnets play an important role in critical sectors of our advanced society as transport, energy, information and communications technology, where efficient technological designs are frequently achieved using them. The great performance of Rare-Earth permanent magnets like $Nd_2Fe_{14}B$ or $SmCo_5$ make them essential in many technological applications, leading to a strong dependency on expensive Rare-Earth elements like Nd, Sm or Dy that are Critical Raw Materials. This situation has forced

permanent magnet industry to search for other viable alternatives based on Rare-Earth free/lean compounds.

Aiming to find new clues, the experimental exploration of new materials begins to be assisted and guided by computational approaches thanks to their advances in calculation speed, accuracy and reliability. In the context of the H2020 European project NOVAMAG, ICCRAM optimized available predicting crystal structure codes in order to improve the performance of structural optimization as well as to perform calculations of intrinsic properties (atomic magnetic moments, magnetocrystalline anisotropy, etc) in a high-throughput manner for magnetic materials. This research has led to encouraging preliminary theoretical results of novel high-performance Rare-Earth free permanent magnets.

Contact:

ICCRAM – Universidad de Burgos
International Research Center in CRMs for Advanced Industrial Technologies (Burgos, SPAIN)
Sonia Martel Martín
Phone: (+34) 947499113
smartel@ubu.es

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BioNanoNet *retrospect*

9th international conference on nanotoxicology

New tools in risk assessment of nanomaterials

19th – 21st of September, 2018, Neuss, Germany

The conference took place on September 19th – 21st in Neuss, near Düsseldorf. This year the focus of the "NanoTox 2018" lay on "New tools in risk assessment of nanomaterials" such as read-across, grouping and categorization. With 14 plenary lectures presented by well-known distinguished experts on topics ranging from nanomedicine to systems toxicology, from predicting models to responsibility of data and further 12 parallel sessions spanning from tissue barriers to exposure assessment to databases to adverse outcome pathways and much more, the program brought together current research leaders in the field of nanotoxicology but also material scientists and chemists, manufacturers and regulators. The conference offered a platform for all interested scientists, industry partners and regulatory bodies to talk about their thoughts on the latest results and developments in nanosafety research.

Especially, the afternoon poster sessions offered the chance to discuss impressive high-quality submissions with all key players of the different topics. Furthermore, an OECD workshop was held on the use of adverse outcome pathways as tool for monitoring and prediction of activities.

The four-day programme covered the following topics:

- Data reliability, grouping and prediction
- Interactions of nanoparticle with bacterial and viral pathogens
- Adverse outcome pathways as a framework for risk assessment
- Young women in science
- Databases and nanoinformatics
- Graphene and 2D materials
- Long-term low dose exposure
- Cheap and robust tests
- Read across of nanomaterial and risk assessment
- Tissue barriers
- Particle dosimetry
- Oral exposure and intestinal handling of nano

BioNanoNet participated the conference and contributed a poster presentation on the topic “The Nanosafety Compendium: A Collection of Resources and Tools to Support Nanotoxicology, Risk & Safety Testing”, introducing the revised and expanded nanosafety expertise folder and the members expertise to the conference attendees.

Another important activity was to disseminate the EU-project NanoCommons, highlighting the work BioNanoNet is contributing to the success of the project.

Impressions from the NanoTox 2018 Conference *© BioNanoNet*

NanoCommons project has received funding from the European Union’s Horizon 2020 programme under grant agreement No 731032.

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ICOETox 2018

4th international congress on occupational & environmental toxicology

24th – 26th of September, 2018, Matosinhos-Porto, Portugal

From 24th – 26th September 2018, the 4th International Congress on Occupational & Environmental Toxicology took place in Matosinhos-Porto, Portugal.

This multidisciplinary conference provided a forum for both internationally established and young researchers to exchange advanced knowledge on toxicology. The congress comprised of keynote lectures given by world-renowned scholars, in addition to oral and poster sessions. State of the Art developments in different fields of toxicology, new methodologies and developing expertise was covered during presentations.

More than 60 exciting lectures and invited talks given by leading international scientists as well as poster presentations offered delegates an excellent opportunity to discuss pioneering developments and to initiate cooperation projects.

The programme covered the following panel sessions:

- Susceptible Populations
- *In vitro* and *in vivo* Testing
- Nanotoxicology
- Ecotoxicology
- Genetic Toxicology
- Air Quality
- Environmental Exposures
- Occupational Toxicology
- Contaminants

BioNanoNet participated the conference and contributed an oral presentation on the topic “Defining Nanomaterial Risk Profiles within the Printed Electronics Industry” presenting the safety work performed in the INSPIRED project.

Presentations at the ICOETox 2018 Congress *© BioNanoNet and Cristina Pinto*

INSPIRED project has received funding from the European Union's Horizon 2020 programme under grant agreement No 646155.

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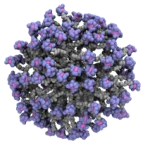
Nano2Clinic - Cancer Nanomedicine - from the bench to the bedside

Kick-Off Meeting, September 28th, 2018



Nano2Clinic

28th of September, 2018, Brussels, Belgium

On September 28th, 2018, the kick-off meeting of the COST Action CA 17140 “Nano2Clinic - Cancer Nanomedicine - from the bench to the bedside” took place in Brussels, chaired by Prof. Barbara Klajnert-Maculewicz.

The action is described as follows: “Finding efficient cancer therapies is an urgent and still unresolved problem and, in the fight against this disease, scientists are devoting tremendous efforts towards the utilization of nanomedicines. Nanotherapeutics exhibit major benefits with respect to unmodified drugs, including improved half-life, more efficient tumour targeting, and reduced side effects. However, only a few nanotherapeutics have reached the commercial level, most still being in the investigational phase. Accordingly, this Action aims at developing and strengthening industry-academia relations with an ultimate goal: fostering the clinical translation of nanomedicine from bench to bedside. This will be achieved by creating the first, pan-European interdisciplinary network of representatives from academic institutions and small and medium enterprises including clinical research organizations (CROs) devoted to the development of nanosystems carrying anticancer drugs from their initial design, pre-clinical testing of efficacy, pharmacokinetics and toxicity to the preparation of detailed protocols needed for the first phase of their clinical studies. By promoting scientific exchanges, technological implementation and innovative solutions, the Action will provide a timely instrument to rationalize and focus research efforts at the EU level in dealing with the grand challenge of nanomedicine translation in cancer, one of the major and societal-burdening human pathologies. By virtue of its quality, the Action network will also generate research core teams of excellence for funding applications, patent filling and discovery of major scientific impact. The network will also be actively devoted to raising awareness on the high potential on nanomedicine through publications in international peer-reviewed journals, and presentations at open events.”

BNN is one of the partners of Nano2Clinic. Furthermore, BNN-members are involved in the management committee of the COST Action: Prof. Ruth Prassl and Prof. Eleonore Fröhlich (both representing the Medical University Graz, Austria), Dr. Ivana Vinkovic-Vrcek (representing Institute for Medical Research and Occupational Health, Croatia), Dr. Johanna Scheper (representing CIBER, Spain).

The first training school is already scheduled and open for your participation; the first call for short term scientific missions is open as well. Further information about Nano2Clinic can be found on the recently published webpage of the action.

These projects have received funding from the European Union's Horizon 2020 programme under grant agreement No 646155 and grant agreement No 720942.

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AMiCI mid-term conference and action meetings

2nd – 3rd of October 2018, Zagreb, Croatia

From 2nd to 3rd October 2018, the AMiCI Mid-Term Conference was held, combined with the Action Management Committee and Core Group Meetings, at the Andrija Stampar Teaching Institute of Public Health, in Zagreb, Croatia.

The European Union COST Action AMiCI brings together experts on the synthesis, use and assessment of unwanted side effects of antimicrobial coatings. The project is coordinated by Francy Crijns (Zuyd University of Applied Sciences and Technology, NL). The opening lecture was held by Francy Crijns, looking back on AMiCI – what has happened in the past two years and what is the outlook for the next couple of years.

The scientific programme of the Mid-Term Conference in Zagreb was dedicated to all four Working Groups and contained several scientific presentations on:

- WG1: Antimicrobial Coatings – Safe by design
- WG2: Performance Assessment of AMC's
- WG3: Adverse effects of AMCs – Risk-benefit analysis
- WG4: New cleaning approaches

The Mid-Term Conference was concluded with an open, interactive and fruitful discussion on the results of the conference, the challenges and the road ahead.

BioNanoNet is part of the AMiCI network and contributes to the action's aims through dissemination and communication activities.

If you are interested in the speaker's presentations form the conference and want to get further formation on the COST Action AMiCI, please visit its official webpage: http://www.amici-consortium.eu/

Plenary talk at the AMiCI Mid-Term Conference in Zagreb, Croatia. © BioNanoNet.

These projects have received funding from the European Union's Horizon 2020 research and innovation programme under grant agreements No 760928, No 720942, No 646296, No 731032 and COST Action 17140.

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OpenTox Euro 2018

9th – 11th of October, 2018, Athens, Greece

Under the title "***Bridging the gap between experimental and computational work in safety and risk assessment***", the OpenTox Association hosted a very interesting conference in Athens, the OpenTox Euro 2018 (9-11 October 2018).

During the first day of the conference took place the 1st NanoCommons Hackathon on "*Ontological Annotation of Datasets*". It was co-organised by the H2020 projects NanoCommons (BioNanoNet members ACBN, UCD, NovaMechanics, and BNN itself, are project partners) and OpenRiskNet in conjunction with the 2nd NanoCommons Consortium Meeting.

The participants of the hackathon used mock datasets and searched through established ontologies (e.g. eNanoMapper Ontology) for ontological annotations. The participants also learned how to prepare electronic files (e.g. JSON) containing the raw data and the ontological metadata.

Luke Slater (University of Birmingham) presenting during the 1st NanoCommons Hackathon © BioNanoNet

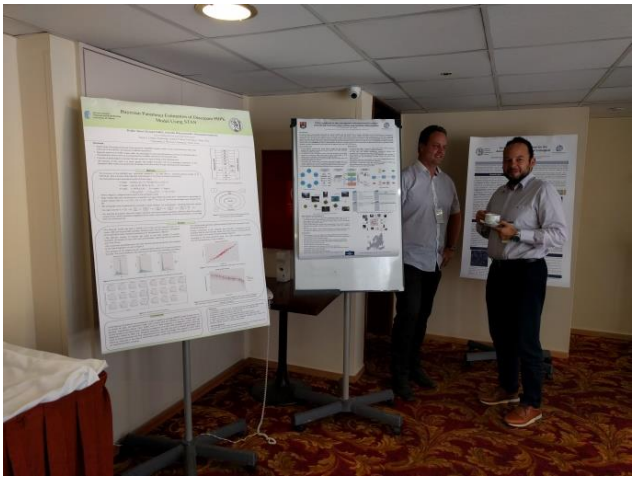
During the second and third day of the conference, experts from all around Europe presented their latest results, projects and activities with big enthusiasm to the interested public.

The programme covered the following conference sessions:

- Experimental and Computational Toxicological Evaluation of Engineered Nanomaterials
- Industrial Applications in Safety Assessment
- Organ-on-a-chip: combining the in-vitro and in-vivo approaches
- In-silico approaches for risk assessment from a regulatory perspective

The conference also offered two Hands-on Workshops on "*Biokinetics Modelling*" and on "*Building risk assessment workflows with OpenRiskNet*".

With participants from many European countries, the conference provided a great platform to build bridges between people and countries, to exchange ideas creating new collaboration possibilities, and to present latest developments and findings in nanotechnology and its applications as well as in safety and risk assessment.



Impressions from the OpenTox conference *© BioNanoNet*

The full programme including all speakers and further information on the conference can be checked here.

This project has received funding from the European Union's Horizon 2020 programme under grant agreement No 731032.

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2nd annual meeting of the Austrian Platform for Personalized Medicine ÖPPM

Joining Forces for Personalized Medicine

11th – 12th October 2018, MED CAMPUS Graz, Medical University Graz

Enhanced interdisciplinary and strategic cooperation shall push the topic of personalized medicine in Austria, which has been driven forward on European and international level, and shall allow to connect Austria to European initiatives. The Austrian Platform for Personalized Medicine (ÖPPM) addresses all stakeholders and interested persons, who want to contribute to researching and implementing personalized medicine in Austria.

The second annual conference of the ÖPPM took place under the theme “Joining Forces for Personalized Medicine”. The conference focused on the interdisciplinary debate on certain aspects of the new medical age, such as genomics, binomics and big data and the use of artificial intelligence specifically. Austrian science projects have presented new smart scientific results of their research. In the lecture hall of the MED CAMPUS Graz over 20 speakers have discussed the economic, social and ethic challenges of personalized medicine with more than 130 participants. A talk about subsidies in Austria has updated the participants about the newest standards of funding guidelines by the Austrian Science Fund (FWF), as well as by the Austrian Research Promotion Agency (FFG).

A forum at the end of the conference, which was opened to the public, summarized the highlights of the lectures led by the president of the ÖPPM Prof. Renate Kain. At this forum representatives of Medical Universities, the University of Vienna, the Main Association of Social Insurances as well as of a European patient organisation were debating crucial opportunities and challenges of personalized medicine in a public plenary discussion.

Are you interested in personalized medicine and want to contribute to shaping the platform? If so, then please support our networking platform with your membership, indicate your areas of interest and engage in one of our working groups of the ÖPPM

The ÖPPM is funded by the Austrian Federal Ministry of Education, Science and Research.

Contact:
Philipp Hofer
office@personalized-medicine.at
www.personalized-medicine.at

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Open campus: Intel – how we think "artificial intelligence"

16th of October, 2018, Graz, Austria

From SIRI to self-driving cars, artificial intelligence (AI) is progressing rapidly. While science fiction often portrays AI as robots with human-like characteristics, AI can encompass anything from Google's search algorithms to IBM's Watson to autonomous weapons. AI will shape the future of human work.

After a short introduction by Johann Harer (CEO Human.technology Styria GmbH), about the role of *Human.technology Styria GmbH* (member of BioNanoNet) in connecting people with companies and politics in order to develop new ideas/projects and to bring the Styrian community to a higher level, the "AI-guru", Bruce Horn (Independent consultant at his own Start-up company) delighted his public with a brilliant speech about big data and artificial intelligence (AI).

Figures 1 & 2: Bruce Horn in action at the event of Human. technology Styria

"Everything we love about civilization is a product of intelligence, so amplifying our human intelligence with artificial intelligence has the potential of helping civilization flourish like never before – as long as we manage to keep the technology beneficial."

Max Tegmark, President of the Future of Life Institute

During his presentation "*Smart Choices – Human-like AI for Creating a Compelling Future*", Bruce Horn tried to explain what the AI will bring and how our society is going to be influenced by it within the next 20-30 years… it is a puzzle!

"There are no passengers on Spaceship Earth. We are all crew."

Marshall McLuhan, one of the most influential communications theorists of the 20th century

Each one of us contributes, although in a very small way, to achieve the transition to a better world. His recommendation: "Think different. Be crazy. Change the world". We need systems that help us making decisions. The future is, per definition, unknown but Artificial Intelligence can help us to learn and remember from the past and, knowing the effects of our actions/reactions in similar situations (in the past) and understanding the consequences of our acts, decide how to behave in order to make better choices for our future.

It was a presentation about human intelligence and human memory, analysing it from the psychological point of view, and explaining why Deep Learning (DL) is insufficient and why it is needed to develop AI-readable which will make smart choices augmenting the human thinking. Bruce Horn also expressed his worries about the potential misuse of AI regarding security and influencing people's opinion.

Around 100 people were attending the event, which was supported by "*Zentrum für Wissens- und Technologietransfer"* and "*Plattform Gesundheitswirtschaft"*, hosted by the *Graz University of Te chnology*.

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SusChem Brokerage Event 2018

23rd of October, 2018, Brussels, Belgium

The SusChem Brokerage Event 2018 took place on 23rd of October, 2018, in Brussels, Belgium. SusChem's vision is for a competitive and innovative Europe where Sustainable Chemistry, Biotechnology and enabling Digital technologies respond to Societal challenges by providing Sustainable solutions.

The event enabled networking, matchmaking, technology scouting and consortia formation opportunities. The brokerage event was an excellent opportunity to meet stakeholders from the large industry, academia, research organisations (RTOs), SMEs and startups to build consortia and submit project proposals targeting the 2019 and 2020 calls of Horizon 2020.

BNN represented the SusChem-AT-members during the networking event in the "NTPs-corner", a special dedicated area for the national technology platforms from European countries. Besides the annual stakeholders-event of SusChem every year in June, the brokerage event is the second most important chance to initiate collaboration in the fields of SPIRE, FOF, NMBP and BBI-topics.

Photo from a great venue of SusChem-brokerage Event 2018, Brussels *© BioNanoNet*

INSPIRED project has received funding from the European Union's Horizon 2020 programme under grant agreement No 646155.

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2nd EU-Asia dialogue on nanosafety

29th of October, 2018, Vienna, Austria

The "2nd EU-Asia Dialogue on Nanosafety", hosted and initiated by the Austrian Federal Ministry Transport, Innovation and Technology (BMVIT) and implemented together with the European Commission, the Asia Nano Forum, EU NanoSafety Cluster and BioNanoNet (BNN), took place on October 29th, 2018 in Vienna. The event supported the cooperation between European and Asian stakeholders in nanosafety, and brought together more than 80 participants. This successful event helped to increase the cooperation with Asia and was another step forward to collaborate globally in the area of nanotechnology and nanosafety in the future. Special thanks shall be addressed to the European Commission, Peter Dröll and Georgios Katalagarianakis, for continuous support for Nanosafety research as this is an important enabling aspect to gain successful translation of nanotech-research. Furthermore, thanks to Alexander Pogany from BMVIT for cofinancing the event and to the Austrian Research Promotion Agency FFG for hosting the event in their facilities.

BNN was leading the organization of the event in its function as member of the EU NanoSafety Cluster coordination team and thus continuing its activities as key player in the European nanosafety ecosystem. The presentations and the results of the workshop are available here. The 3rd Dialogue on Nanosafety will take place in Thailand in March 2019. If you are interested to become part of this important activity, please contact the BNN-team.

Group photo from 2nd EU-Asia Dialogue on Nanosafety.

These projects have received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 646296 646155 and No 731032.

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INDustrial TECHnologies 2018

30th – 31st of October, 2018, Vienna, Austria

The European conference "INDustrial TECHnologies 2018 - Innovative industries for smart growth" (INDTECH2018) welcomed more than 1000 participants from more than 30 countries in Europe and across the globe to Vienna from 30th – 31st of October, 2018. INDTECH2018, an event of the Austrian Presidency of the Council of the European Union, combined keynote presentations, talks, a matchmaking event and exhibitions. It provided an excellent opportunity to meet experts from industry, academia and policy to exchange information and to strengthen collaboration. INDTECH2018 anticipated 1,100 participants from more than 30 countries in Europe and across the globe.

BNN participated in the "Austrian Innovators"-booth which was initiated by the BMVIT and presented to the participants in one booth the Austrian key platforms in the field of industrial technologies. Furthermore, this was a great opportunity to raise awareness for the BNN-members' expertise which could be presented with the compendia "2018 edition BNN Compilation of NanoTox NanoSafety" and "NANOMEDICAL TECHNOLOGIES AND APPLICATIONS".

Opening meeting of Austrian Innovators booth with Jean-Eric Paquet (Director General, Research & Innovation at European Commission) and Michael Wiesmüller (bmvit) at IndTech 2018.

These projects received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 646296, No 646155 and No 731032.

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NanoSafe 2018

6th international conference on health and safety issues related to nanomaterials

5th – 9th of November, 2018, Grenoble, France

Following the successful outcome of the five past international conferences on Safe Production and Use of Nanomaterials: NanoSafe 2008, 2010, 2012, 2014 and 2016, the Platform NanoSafety “PNS” organised this sixth edition again at Minatec, Grenoble from November 5th to 9th. The conference gathered about 300 attendees with the interest of exchange information on their latest research progresses and to share the future trends in research, safe fabrication and use of nanomaterials.

NanoSafe Conference 2018 © CEA

The NanoSafe 2018 conference topics include:

I. Measurement and characterization of nano objects ***(Chairman: Daren Chen)***

II. Exposure ***(Chairman: Christof Asbach)***

III. Manufactured nano-objects ***(Chairman: Wendel Wohlleben)***
   a. Nano-objects release from nano-enabled products
   b. Safe-by-Design nano-enabled products and process
   c. Pilot plant production / Industrial issues

IV. Risks ***(Chairman: Keld Alstrup Jensen)***
   a. Occupational risk assessment
   b. Environmental risk assessment
   c. Tools and commercial equipment
   d. Risk management
   e. Nano responsible development and sustainability

V. Nano objects and Health / Hazard ***(Chairman: Claude Emond)***
   a. Toxicology
   b. Environmental interactions of nanomaterials
   c. Safe use of nano objects for medicine applications

VI. Regulation / Standardization ***(Chairman: Anthony Bochon)***

VII. Urban particles ***(Chairman: David Pui)***

Being part in several nanosafety-related H2020 projects, BioNanoNet was invited to present the project NanoCommons and its corresponding nanosafety activities in the poster exhibition.

Furthermore, initiated by the NanoSafety Cluster Working group E (chaired by Andrew Nelson, University of Leeds), BioNanoNet co-organized a workshop “Safety aspects in pilot lines an EPPN-NSC i2L joint session”, together with Simon Clavaguera (local host, CEA) and Amro Satti (chair of European Network for Pilot Production Facilities and Innovation Hubs (EPPN), LEITAT). The workshop allowed to bring together all nano-safety relevant experts from pilot line/production projects, hence, real-life and application-oriented nanosafety and Safe-by-Design expertise. The interactive session promoted discussion between EPPN and NSC in order to address the needs from pilot projects with nanosafety expertise. The main objective of the workshop was to help pilot projects to assess and tackle safety issues throughout harmonization of the approaches and promotion of available tools.

BioNanoNet participated the workshop and contributed an oral presentation related to the “NanoFASE - INSPIRED cooperation”, presenting the joint case study between the pilot line project INSPIRED and the nanosafety project NanoFASE.

On the left: Claus Svendsen (NERC) & Christa Schimpel (BioNanoNet) presenting the NanoFASE/INSPIRED collaboration; Panellist of the EPPN/NSC workshop (middle); Georgios Katalagarianakis representing the European Commission (on the right). © CEA

These projects have received funding from the European Union's Horizon 2020 programme under grant agreement No 646155 and No 731032.

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COST – Awareness Day 2018

6th of November 2018, Vienna, Austria

On November 6th, 2018, the COST Awareness Day „Promotion of RTI networking: COST - A story of success!", was organized by the Austrian Research Promotion Agency (FFG), within the scope of the Austrian EU council presidency. The event addressed experts from all RTI fields, no matter whether they are newcomers or already acquainted with the COST programme.

The 3 hours event was chaired by Nicole Schmidt, Austrian national contact point for the COST programme, and included a keynote from COST director Ronald de Bruin, information on how to participate in the programme as well as input from successful proposers.

BNN supported the event by participating in the panel discussion and could further strengthen its network by connecting with Austrian researchers and industrial stakeholders towards future collaboration.

100+ participants at the COST Awareness day. @FFG.

These projects have received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 646296 and No 646155.

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1st BIORIMA stakeholder workshop

6th of November 2018, Valencia, Spain

"Integration" was the underlying keyword of the 1st BIORIMA Stakeholder Workshop, which was held in the beautiful Spanish city of Valencia on 6th of November 2018.

Over 40 participants from regulatory, industry and academic research fields have gathered to contribute to the interdisciplinary dialogue and to develop a shared approach for understanding and managing risks of Nano-Biomaterials (NBM) used in medical devices (MD) and advanced therapy medicinal products (ATMP).

The workshop was planned as a forum for sharing knowledge and perspectives on risk assessment and management through all life cycle stages of NMB and represented a unique opportunity to discuss latest regulatory and scientific issues of NBM risk management. During the workshop, the aims and characteristics of the BIORIMA risk management framework were presented, together with an overview of target NBM and their biomedical applications considered in the project.

The proposed strategies for human health and ecological risk assessment, benefit-risk assessment, risk prevention and control of NBMs were illustrated, and different aspects of the framework were discussed among participants. Separate break-out sessions allowed further engagement and facilitated to consider thoughts and ideas from different stakeholder groups.

This workshop was instrumental for the BIORIMA project, aimed to develop an overarching framework for risk assessment and management of NBM used in MD/ATMP. The inputs from stakeholders will allow BIORIMA to provide a tool which is truly based on users` needs as well as regulatory requirements and scientific knowledge, to SMEs and industrial manufacturers in Europe and beyond.

BioNanoNet is part of the BIORIMA consortium and adds expertise in the case study development, that will significantly contribute to test the developed tools in real-life innovation processes.

For more information on the project as well as the further project events, please visit the official project's webpage www.biorima.eu.

Impressions of the 1st BIORIMA Stakeholder Workshop in Valencia. *©BIORIMA Consortium*

BIORIMA has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 760928.

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Workshop “standing up for science”

30th of November 2018, Barcelona, Spain

The EU workshop “Standing up for Science”, organised by Sense about Science, took place on the 30th November 2018, at the Institute for Research in Biomedicine (IRB) in Barcelona, Spain. The full day event was focusing on strategies **how to make researcher’s voices heard in public debates about science and evidence,** addressing STEM and social science early career researchers, trainees and medical professionals.

During this event, researchers who have engaged with the media and with policy shared their experiences. Participants also learnt from policy makers about why good evidence is important for them and how researchers can help inform policy. Additionally, respected science journalists talked about how the media works, how to respond and comment, and what journalists expect from scientists and researchers. The attendees got useful hints and tips on how they can start standing up for science, and how to involve the public in communicating research.

The workshop was an inspiring event and facilitated fruitful discussions between the panellists and the participants. The event built a great platform for sharing knowledge and experiences, several hands-on sessions motivated everyone to deeply step into the topic of effective science communication to policy makers, the media and the general public, in order to increase the impact of scientific research in Europe and globally.

BioNanoNet is part of the H2020 Marie Skłodowska-Curie Action NANOGENTOOLS and was invited by the Marie Skłodowska-Curie Alumni Association (MCAA) to participate to this interesting hands-on workshop, sharing expertise on stakeholder engagement with other attendees and gaining new knowledge on how to effectively interact with policy makers and the media.

"Standing up for Science" workshop in Barcelona, Spain. © Sense about Science.

These projects have received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement No 691095 and No 646296.

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Secondments in NANOGENTOOLS Project

September – October 2018, Graz, Austria

NANOGENTOOLS is a H2020 MSCA-RISE project to exchange knowledge in nanosafety. The 4-year European project, devoted to the development and implementation of a new generation of nanosafety assessment tools, was launched in January 2016, and addresses the challenge of identifying and controlling the hazards associated with Nanomaterials by joining industry and academia to create a collaborative excellence-based knowledge exchange network in the MSCA-RISE framework. The project is delivered through cross-sectoral/disciplinary secondments linking EU academic institutes/networks with industry including SMEs and policy makers across different European countries. The secondments play a key role in facilitating knowledge exchange between experts with different backgrounds and knowledge.

Secondment of SITEX45 to BioNanoNet

In September and October 2018, Dumitru Ulieru, CEO of SITEX45, was seconded to BioNanoNet. The time spent in Graz was used to gain deep insights into BioNanoNet's and SITEX's activities and to work on NANOGENTOOLS objectives. SITEX45 is a Romanian SME based in Bucharest and focuses on:

- Prototyping and manufacturing of microelectronic and optoelectronic devices, sensors and nano-sensor arrays, actuators and transducers, microsystems as MEMS & MOEMS for chemical and environmental monitoring, acoustic, optical and biomedical sensors;
- Micro- & nanotechnology applications for new materials processing and development of innovative products by unconventional technologies applications;
- Design and engineering, prototyping and microproduction for sensors and micro-/nanosystems by new materials' applications including nanostructured biocompatible and multifunctional thin films;
- Sensor packaging technologies and applications, and smart systems integration applications, including Wireless System Networks.

Secondment of NovaMechanics to BioNanoNet

In September and October 2018, BioNanoNet hosted additionally Dimitra-Danai Varsou, PhD student, and Antreas Afantitis, CEO of NovaMechanics Ltd at their office in Graz. The secondment period was dedicated to gain deep insights into BioNanoNet's and Nova-Mechanic's activities, and to work on NANOGENTOOLS objectives. NovaMechanics Ltd is an in silico material design company committed to the computer aided design of new materials, small-molecules and nanoparticles. NovaMechanics Ltd is focused in the development and implementation of in silico methods to guide decisions in the design and selection of promising new compounds. NovaMechanics contribution to the NANOGENTOOLS project is the application of cheminformatics methods such as quantitative structure-activity relationship (QSAR) modelling to establish statistically significant relationships between measured biological activity profiles of NMs and their physical, chemical, and other properties, either measured experimentally or computed from the structure of NMs. These secondments were already the third secondment-exchange between BioNanoNet and Nova-Mechanics, and provided a great chance to further share and exchange knowledge, expertise and experiences.

BioNanoNet hosting NovaMechanics and SITEX45 in Graz, Austria. *© BioNanoNet.*

Further information on the NANOGENTOOLS project and updates on developments can be obtained from www3.ubu.es/nanogentools.

NANOGENTOOLS has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 691095.

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Secondment of BioNanoNet to SITEX45

November - December 2018, Bucharest, Romania

In November - December Andreas Falk, CEO of BioNanoNet, was seconded to SITEX45. Several activities could already be started during the secondment of SITEX45 in Graz. Now, the time spent in Bucharest helped to further elaborate the safety relevant work e.g. assessment of the potential implementation of safe-by-design in manufacturing processes, to identify collaboration ideas and thus to work together on NANOGENTOOLS objectives. This secondment also enabled to get additional points of view supporting the nanosafety-work done by BioNanoNet in pilot projects INSPIRED and Hi-Response, as well as broadening of the new member states community building activities of NanoCommons.

Furthermore, it provided a great chance to further share and exchange knowledge, expertise and experiences, to get to know the colleagues at SITEX45 and discuss about the importance of safety-aspects in their processes.

SITEX45 hosting BioNanoNet in Bucharest, Romania. *© BioNanoNet & SITEX 45.*

Further information on the NANOGENTOOLS project and updates on developments can be obtained from www3.ubu.es/nanogentools.

These projects have received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement No 691095, No 731032 and No. 646155.

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BioNanoNet *conference calendar*

BioNanoNet events

BioNanoNet General Assembly, Call Matchmaking Event & Networking

The call matchmaking event & BioNanoNet Networking is public!

When? 27 February 2019

Where? Vienna, Austria

Click on REGISTER to register now!

Austrian Microfluidics Initiative 1st Scientific Meeting

This event is public!

When? 28 February 2019

Where? Vienna, Austria

Click on REGISTER to register now!

BioNanoNet Annual Forum 2019

When? 10 September 2019

Where? Salzburg, Austria

Please save the date! More information coming soon.

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BioNanoNet on site events

HTH Styria Pitch & Partner 2019

When? 15 January 2019

Where? Graz, Austria

For more details please visit BioNanoNet website.

Brokerage Event on Key Enabling Technology

When? 31 January 2019

Where? Venice, Italy

For more details please visit BioNanoNet website.

2019 EU Industry Days

When? 5 – 6 February, 2019

Where? Brussels, Belgium

For more details please visit BioNanoNet website.

Open Nanoscience Congress 2019

When? 26 February 2019

Where? Salzburg, Austria

For more details please visit BioNanoNet website.

2nd International Congress on Advanced Treatments in Rare Diseases

When? 4 – 5 March 2019

Where? Vienna, Austria

For more details please visit BioNanoNet website.

1st Interprofessional Education Nano Training School

"Cutting Edge Approaches for the Risk Assessment and Management of Nano-(bio)materials: From the Lab to the Market"

When? 25 – 29 March 2019

Where? Venice, Italy

About the School

The **Nano Training School**, co-organized within the EU funded Horizon 2020 projects BIORIMA, GRACIOUS and the COST Action NANO2CLINIC, will take place in the historic center of Venice, Italy, on 25th – 29th March 2019. The aim is to transfer State-of-the-Art knowledge on key topics to the new generation of nanoenvironmental, health and safety, and biomedicine professionals, using interprofessional education in hands-on sessions.

Become part of an interactive, exciting week and enrich your knowledge by developing multidisciplinary expertise!

Topics

- Nano-(bio)materials' Fate & Exposure Scenarios
- Hazard to Human Health & Environment
- Risk Assessment & Risk Management
- Modeling, Grouping and Read Across Approaches
- Translational Nanomedicine in Cancer Therapies

Venue

The Training School will take place in Venice historical centre (Italy). The main School program will take place in the historic Auditorium Santa Margherita Venice, Italy.

Target Audience

The School is especially designed for personnel from research and academic institutions as

well as from industry, governmental agencies and hospital departments. The School is aimed at senior researchers, young scientists, PhD students and in fact anyone Anyone interested in Safe Nanotechnology, Risk Assessment and Nano-Medicine.

Benefits from Attending the School

- Learn the latest trends in nanosafety and nanomedicine.
- Gain an in-depth interdisciplinary understanding of the key topics.
- Engage in a dialogue with peers and key experts.
- Benefit from a variety of additional networking opportunities such as a boat trip in the Venetian
- Lagoon and a social dinner.

For more information, please visit the School's webpage.

We are looking forward to welcoming you in Venice!

Organisers

These projects have received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 760928 and No 760840 and COST Action 17140.

BioNanoMed - 10th International Congress Nanotechnology in Biology & Medicine

When? 15 – 17 April 2019

Where? Graz, Austria

We have the pleasure of inviting you to submit an abstract for the 10th International Congress - BioNanoMed 2019 – the exclusive Know-How-Transfer meeting for researchers, engineers, students and practitioners from Natural Sciences, Medical Sciences and Engineering Subjects throughout the world.

Topics:

Session A – Nanomaterials for Medicine
Session B – Nanotechnology in Medical Diagnostics and Therapy
Session C – Pharmaceutical Nanotechnology in Research and Development
Session D – Nanotechnology in Cancer and Immunotherapy
Session E – Nano-enabled Microfluidics and high-throughput Technologies

Exhibition:

BioNanoMed 2019 serves as an excellent platform to present your company/institution, to promote your product portfolio and to establish direct links to a broad audience of experts.

BioNanoMed 2019 is jointly organized by Techkonnex - High-Tech Promotion and the University of Graz, Institute Pharmaceutical Technology & Biopharmacy in cooperation with Medical University Graz.

Graz is Austria's 2nd largest city with the beautiful historic old town being a UNESCO World Cultural Heritage! Visitors are highly enthusiastic about this city and the attractive cultural programme.

BioNanoNet members get a 10% discount on registration fee. Please register by sending an email to office@bionanonet.at until 15th of March 2019 by the latest!

For all events visit our BioNanonet website!

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BioNanoNet member event notifications

Click HERE for further information about this event!

Click HERE for further information about this event!

Expo Lounge Karlsruhe: **Cleanroom and pharmaceutical technology in focus**

05th – 07th of February 2019

Be Part of the ***Austria Corner*** at the Expo Lounge in Karlsruhe, with the aim to portray the variety of the Austrian scientific activities with regard to clean room technology or production processes. More information about the event can be found on the following web-page: www.x4com.de. We are looking for Poster presentations from Austrian Research Organisations or Start-ups, who work in the field of clean room technology or pharmaceutical processes. Presenting a poster gives the opportunity to show your scientific results or your

ideas to a target orientated audience and to participate in one of the most important events in the sector of clean-room technology in Germany and is free of charge.

More information:

Elisabeth Jöbstl
0043 316 58 70 16 20 or 0043 699 188 99 709
elisabeth.joebstl@human.technology.at

Click HERE for further information about this event!

acib is an international competence centre, developing new, environmentally friendly, economically and technically advanced processes for the biotechnological, pharmaceutical and chemical industry – all of them modelled on nature. acib is bridging the gap between academic research and producing industry. acib and their partner organisations translate scientific results into concrete processes and products by using scientific know-how, academic infrastructure or industrial networks. acib is a hub of industrial biotechnology with several national and international scientific partners with Graz University of Technology (TUG) as one of the most important. Together, acib and TUG open their doors, to allow a glance behind highly recognised research in nearly all fields of industrial biotechnology.

Contact:

Human.technology Styria GmbH
Julia Pirkenau, Marketing & PR
Tel: +43-316-587016-17
julia.pirkenau@human.technology.at
www.humantechnology.at

2nd European Organ-on-Chip Conference – EUROoC 2019

2nd – 3rd of July, 2019, Graz, Austria

SAVE THE DATE!

EUROoC 2019 – Conference covers all aspects related to the research, development and application of Organ-on-chips. Scientists and Developers are invited to submit their original contributions in one or more of the following topics:

- Micro- and Nanoengineering
- Microfluidic interfacing
- Actuators for dynamic culture
- Integrated sensors and analytics
- 3D cell culture environment
- Cellular engineering
- Automation
- Pharmokinetical modeling

Our goal is that the EUROOC meeting series will **become the natural meeting place for the European organ-on-chip researcher community**. EUROoC conference is the annual meeting of the recently founded European Organ-on-Chip Societey. We will especially invite group leaders in the organ-on-chip field and encourage them to bring their students to the meeting. It is our ambition that **this conference series will become an annually event for researchers at all levels**, where PhD students and PIs have the opportunity to present and discuss their work in oral and poster presentations. The program will be highlighted by 6 keynote lectures from renown experts in the field and allow ample time for networking in a relaxed and social atmosphere.

EUROoC conference is the annual meeting of the recently founded European Organ-on-Chip Society.

Find here more information: www.eurooc2019.eu

About Organ-on-Chip systems

An Organ-on-Chip is a fit-for-purpose microfluidic device, containing living engineered organ substructures in a controlled microenvironment, that recapitulates one or more aspects of the organ's dynamics, functionality and (patho)physiological response *in vivo* under real-time monitoring.Organ-on-chip models are expected to result in a paradigm shift for healthcare leading to new ways to elucidate disease mechanisms, identify effective drugs and improve health by prevention and personalized cure of many diseases.

Contact:
TU Graz – Institute of Analytical Chemistry and Food Chemistry
Torsten MAYR
Tel: +43 (316) 873 - 32504
torsten.mayr@tugraz.at
www.tugraz.at/institutes/acfc

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Finally

We hope you enjoyed our BioNanoNet newsletter!
Please do not hesitate to contact us if you would like to give us any suggestions or feedback!

Our next BioNanoNet newsletter will be published in March 2019.

BioNanoNet partners are welcome to send their contributions until 8th of March 2019!

Contact:
BioNanoNet Forschungsgesellschaft mbH

Simone Jagersbacher

simone.jagersbacher@bionanonet.at or info@bionanonet.at

phone: +43 699 155 266 02

www.bionanonet.at

The BioNanoNet team wishes you
a Merry Christmas,
relaxing holidays and a
healthy, joyful and prosperous
New Year!

The BioNanoNet office will be closed from 24th of December, 2018 until 4th of January, 2019!

Your BioNanoNet team

from the left …

Christa Schimpel, Beatriz Alfaro Serrano, Susanne Resch, Andreas Falk, Gabriele Katz, Christine Halbedel, Angelika Halbedl-Herrich, Simone Jagersbacher and Nikolaus Ladenhauf

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